YEAR 2005 ANNUAL MARINE FISHERIES REPORT

EVERGLADES NATIONAL PARK

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INTRODUCTION

National Park Service (NPS) management policies state that recreational fishing is permitted in parks when it is authorized by federal law or is not specifically prohibited, and is in accordance with applicable federal/state laws and regulations. However, the NPS may restrict fishing activities whenever necessary to achieve management objectives. NPS goals and management objectives are based on the preservation of diversity and ecological integrity of fish populations. When harvest is permitted, in no case should it be allowed to reduce the reproductive potential of the population or to radically alter its natural (unfished) age structure. Fishing activity and harvest of gamefish from Everglades National Park (ENP) have been monitored nearly continuously since 1958. The objectives of marine fisheries monitoring in the park are to estimate the Catch Per Unit Effort (CPUE, also known as catch rate), relative abundance, age structure, total catch and harvest, and boating and fishing activity.

This monitoring program was initiated because of concern over increased fishing pressure resulting from the construction of a paved road to Flamingo, marina facilities, and an access canal to Whitewater Bay in 1958. The first ten years of the park's fishery monitoring program (1958-1967) were conducted through the University of Miami's Institute of Marine Science and were directed at evaluating only the sport (recreational) fishery. Under this program, measures of catch and CPUE (catch rates) were made only from those anglers operating out of Flamingo. This data covered a large part of the ENP fishery, but missed two other major areas: eastern Florida Bay and the lower 10,000 Islands (see Figure 1).

In 1965, a permitting system was established for commercial fishermen operating within ENP. These fisheries included commercial hook & line (primarily spotted seatrout), netting (mullet and pompano), stone crab trapping, and professional guides. Until 1972, this catch data consisted of monthly total harvest, by species, for each fisherman. The harvest reports did not include any measure of fishing effort (the number of people fishing multiplied by the number of hours spent fishing) or specific area of harvest. Therefore, it was not possible to monitor populations by ecosystem or management unit or to evaluate the degree to which fishermen complied with their reporting requirements. In 1985, commercial fishing (except for professional guiding) in ENP was eliminated.

In 1972, the NPS expanded the fisheries monitoring program to include daily trip ticket reports from commercial permit holders and developed censusing techniques to evaluate total parkwide sport fishing and commercial effort. The primary emphasis of the expanded monitoring was to improve the precision of catch rates and the total fishing effort estimates for both recreational (sport) and commercial fisheries (Davis 1979a). In 1974, fish length data were added to the information recorded to evaluate important parameters such as age structure, mortality rates, and response to changes in fishing effort and harvest. In 1980, Chokoloskee-Everglades City (lower 10,000 Islands) boat ramp surveys were added on a routine basis. Catch data from Area 6 (lower 10,000 Islands) are almost entirely from Chokoloskee-Everglades City

interviews, and catch data from Areas 1-5 are mostly from interviews conducted at Flamingo (see Figure 1).

In 1978, a second detailed account of the park's marine fishery database was completed in response to recreational and guided angler complaints of declining stocks. The results of this assessment were incorporated into a document for public review concerning alternative fishery management options for ENP (Davis 1979b). This assessment summarized the estimated total harvest of fish from ENP waters by species, by area, and angler type from 1973-1977; however, no detailed analysis of catch rate response to changes in effort or to environmental factors were made.

During the late 1980's, Virtual Population Analysis (VPA) cohort stock assessments for the park's major fish species, based on an eleven-year collection (1974-1984) of 40,000 fish length measurements, were conducted. VPA's are statistical models which use catch data to produce relative estimates of how many fish of a given species exist or how many fish of a particular age class are surviving to become reproductive adults. ENP stock assessments included total mortality estimates, age structure, and a yield-per-recruit analysis for the three most commonly caught gamefish species: spotted seatrout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), and gray snapper (*Lutjanus griseus*) (Tilmant et al. 1986, Rutherford et al. 1989a, 1989b). This review concluded that environmental factors might explain as much of the variability in fish abundance as fishing pressure does.

Stock assessments, status and trend reports, and fisheries presentations for the period 1995-2004 are briefly discussed in previous annual fisheries reports. For years 2002 through 2005, project personnel participated in several scientific and management meetings, and stock evaluations/assessments. The emphasis was on the status of the common snook (*Centropomus undecimalis*) populations, and the development of the new regulations for the west coast of Florida, which were based partially on the analysis of the park's marine fisheries database. Other on-going snook issues included causes of short-term changes in catch rates of snook and snook/red drum differences in catch rates associated with live bait and artificial bait use in the coastal waters of the lower 10,000 Islands area of ENP. Although no significant differences in catch rates were found for snook/red drum in the bait analysis, ENP provided information to FFWCC (Florida Fish and Wildlife Conservation Commission) for the snook bag limit reductions and the increased seasonal closures (effective 1/1/2002) as proposed by FFWCC. In addition, FFWCC made their determination to change the snook regulations based on information collected from all over the state of Florida.

ENP port samplers are currently involved in a collaborative effort with one of FFWCC's fishery biologists, Ron Taylor, to assess the condition of snook stocks throughout South Florida. Park personnel interview anglers to determine the size (either within the slot size of 26" to 34", under the slot, or over the slot) of the snook that they released (or harvested). Pertinent biological samples (otoliths) are taken from harvested snook to determine the age of each individual fish.

The information used in the "catch and release" practices of recreational anglers helps to investigate the size of fish that remain within the ENP snook stock. Gonads of female snook harvested by anglers are also sampled to determine the reproductive status of each fish. In addition, fin clips of harvested snook are sampled to determine if there are genetic differences between snook located in the eastern and western portions of ENP. The fin clip samples are stored in alcohol, the otoliths are stored dry in vials, and the gonads are stored in formalin. The samples are then sent to St. Petersburg, Florida for analysis. The results of this report are available in a FFWCC publication entitled "The 2005 Stock Assessment Update of Common Snook, *Centropomus undecimalis*" (Muller and Taylor, 2006).

An analysis of the marine fisheries database was undertaken as part of a request from National Marine Fisheries Service (NMFS) Protected Fisheries Division (St Petersburg) to document the abundance of smalltooth sawfish and goliath grouper in South Florida. It was found that the vicinity of the park's coastal waters serves as the last stronghold for smalltooth sawfish in the United States. In April 2003, the smalltooth sawfish was the first fully marine finfish species to be protected by the Endangered Species Act (ESA). Smalltooth sawfish visual and acoustical tagging studies have been implemented in ENP waters to determine/monitor their movement, distribution, and abundance. The ENP database has been used to monitor the recovery, abundance, and distribution of smalltooth sawfish in extreme South Florida. Over a 15 year period (1989-2004) 158 smalltooth sawfish have been reported by recreational (sport) anglers and 266 were reported by professionally guided anglers. A draft paper is also under preparation with John Carlson (NMFS-Pascagoula, MS) to develop a standardized index of abundance for the smalltooth sawfish. Subsequently, a manuscript will be submitted for publication in the journal Biological Conservation and at the American Society of Ichthyologists and Herpetologists Annual Meeting. In addition, Schmidt was appointed as the NPS representative on the Sawfish Recovery Team (SRT). The SRT was formed to develop a recovery plan for the endangered species, per the provisions of the ESA. A draft of the smalltooth sawfish Recovery Plan has been completed (in accordance with the ESA) by the SRT.

The ENP database continues to be used to monitor the recovery, abundance, and distribution of goliath grouper, another protected marine species of fish, in South Florida. Data from the park's (sport) recreational (or also known as the creel survey) database were used to calculate a "catch: effort series" as an index of abundance of the sub-adult segment of the goliath grouper stock (Cass-Calay and Schmidt, 2003). Schmidt is also a co-author of a draft report regarding the standardized catch rates of juvenile goliath grouper, *Epinephelus itajara*, from the Everglades National Park Creel Survey, 1973-2004 in relation to environmental conditions (Cass-Calay and Schmidt, 2003). With assistance from NOAA (National Oceanic and Atmospheric Administration) and the Mote Marine Lab, the creel database will also be used to develop an index of abundance for large predatory inshore South Florida shark populations. A poster on the sharks of ENP was prepared by the Mote Marine Lab (Tonya Wily) and presented at the Florida Bay Science Conference in December, 2005.

Continuing conceptual model developments for various coastal CERP (Comprehensive Everglades Restoration Project) and Biscayne Bay Coastal Wetlands projects identified interactions between ecosystem dynamics and higher trophic levels in Florida Bay and adjacent marine waters, focusing, in part, on adult spotted seatrout and snook catch rates. Various Federal and State interagency meeting participants identified draft ecological performance measures as indicators of ecosystem restoration. Snook, gray snapper, and spotted seatrout CPUE are under development as performance measures for both the Florida Bay/Florida Keys and Southwest Florida Feasibility studies and, along with other recreationally important species, will be considered in the CERP evaluations and the decision making process.

As part of the park's General Management Plan, a project entitled "Aerial Survey of Boater Use in Everglades National Park Marine Waters" has been contracted to the University of Miami's, Rosenstiel School of Marine and Atmospheric Science (RSMAS) to investigate the stress placed on the marine organisms over the past several decades, due to a combination of a rapidly growing human population, increased levels of fishing and boating activity, habitat alterations, and changes in regional water quality, quantity, and timing in distribution. However, due to the Hurricane Katrina and Wilma park closures, the aerial survey has been postponed until fall 2006.

A health advisory remains in effect for five species of marine fish found in northern Florida Bay and for largemouth bass, which are typically caught in areas that are inundated with freshwater. People should not eat bass caught north of the Main Park Road more than once per week because of their high levels of mercury. The average mercury level of spotted seatrout, gafftopsail catfish, crevalle jack, ladyfish, and bluefish is also in excess of the state limit for human consumption. Adults should not consume these species more than once per week, and children and women of childbearing age should not consume more than one fish per month.

This is the eleventh annual fisheries report produced since 1990. Due to severe personnel shortages, only basic data collection activities were maintained from 1991-1994 by port samplers at Flamingo and Everglades City. This report includes a description of the fishery, the relative abundance and average size of the four major gamefish species in 2005, as well as comparisons with previous years. In addition, estimated total catch, estimated total harvest, fishing effort, and boating activity are included, as well as correlations between environmental parameters and catch rates from 1985-2005.

METHODS

Methods (data collection and recording format) employed to obtain recreational fishing monitoring and boating activity data in ENP have been previously presented by Higman (1967), Davis and Thue (1979) and Tilmant et al. (1986), and are briefly discussed below. A random number of recreational anglers are interviewed at boat launch sites (Flamingo and

Chokoloskee/Everglades City) upon completion of their trip every weekend. Data recorded include area fished (see Figure 1), number of fish kept and released, effort, species preference, angler residence, and fish lengths. Professional guides are required to obtain an annual permit from ENP and report their monthly catch and effort on a per trip basis via logbooks supplied with the permit. Prior to 1980, reporting by guides was voluntary. Reporting compliance of the professional guides is determined from recorded field observations by park rangers and port samplers at the boat launch sites. Since the elimination of commercial fishing in ENP in 1985, only professionally guided and recreational (sport) anglers are permitted to fish within ENP waters.

Daily estimates of the total number of fishing boats operating in park waters were made by regressing the daily counts of empty trailers at Flamingo against a known number of boats fishing the same day. Aerial surveys were used to determine the correlation of boat trailers at the Flamingo parking lots to the total number and distribution of boats within ENP. Over 243 flights were conducted using randomly selected weekdays and weekends stratified by month for three sample periods (July 1972 to May 1975; October 1977 to October 1978; and October 1983 to October 1984). Highly significant linear relationships between the number of trailers at Flamingo and the total number of boats observed in the park were obtained during each sampling period. The accuracy of the aerial observers was about 94% (152 known patrol boats on the water, 143 sighted). No significant differences were found among the regression statistics for the three survey periods and therefore all the data were pooled to strengthen the expansion estimates ($r=0.84$, $N=243$, $p<0.01$) (Tilmant et al. 1986). There was no significant difference in the boat count/trailer count regression between weekdays and weekends. The percentage of recreational boats actually fishing was determined from boater interviews.

Flamingo is by far the greatest single access point to Florida Bay and has been used by approximately 50-60% of the anglers. During 1972-1974 and 1981-1984, additional interviews were obtained at boat ramp sites along the Florida Keys (Key Largo). However, no significant differences were found in the catch composition or catch rate of these anglers when compared to those anglers fishing the same areas that were interviewed at Flamingo (Tilmant et al. 1986).

Estimates of total recreational catch and harvest of individual fish species for the recreational (sport) fishery were determined by applying the recorded mean catch (or harvest) of that species per successful trip to the estimated total number of fishing trips successful for that species. The estimated total number of recreational fishing trips for a species was determined by applying the proportion of recreational boats contacted by interviewers that were successful for the species, to the estimated total recreational boats determined by the boat count/trailer count. Statistical differences were found between Everglades City (Area 6) and Flamingo (Areas 1-5) interviews; therefore, total estimated catch and harvest computations were made separately for the Everglades City and Florida Bay regions and then added to obtain parkwide estimates (Tilmant et al. 1986).

Estimates of total catch and harvest for the professional guide fishery were obtained by dividing the reported catch and harvest (separately) by the percentage of guides that were in compliance with sending in their logbook reports. Not all permitted guides reported their catch as required; therefore, a reporting compliance adjustment was necessary. The estimate of reporting compliance (as determined through independent field observations of fishing activities) was less than 29% in 2005.

The mean annual catch rates (CPUE) and harvest rates (HPUE) were calculated after Malvestuto (1983). Only those anglers successful in catching a species were used to calculate a catch or harvest rate to avoid bias in the possible change in the proportion of effort applicable to a species each year. The exception to the above statement is true for all cases except for determining the harvest rates for tarpon and bonefish (see pages 19-20), where the harvest rates were not included in the analyses for these two species.

Fish lengths taken from recreational (sport) anglers in 2005 were analyzed (Figures 11-15) to determine if there were differences in fish lengths among the different ecological fishing areas (see Figure 1) and seasons. A parametric one-way ANOVA (F) was used to test differences in mean harvest length by area and season. The degrees of freedom (df) for the analysis are written as a subscript after F, where the first number describes the df for the model (or between groups) and the second number describes the df for the error (or within groups). If a significant difference was detected for an ANOVA ($p<0.05$), a Tukey's Multiple Comparison test was used to test for particular differences.

RESULTS

In 2005, ENP was closed during and after Hurricanes Katrina and Wilma passed through South Florida. As a result, the creel survey was not completed between August 26 and September 10, 2005 and between October 22 and December 17, 2005 at Flamingo; therefore fewer surveys were completed and less data were collected compared to previous years. In contrast to operations being closed at Flamingo for approximately four months this year, interviews at Everglades City continued to be conducted in all but three weeks of the 2005 hurricane season. The results of this year's annual marine fisheries report reflect lower than normal sportfishing and boating activity due to the post-hurricane conditions and closures within ENP.

Nearly all of the recreational (sport) angler catch data for Florida Bay and the immediately adjacent waters (Cape Sable, Whitewater Bay, and Shark River area, hereafter referred to as Florida Bay) have come from marine fisheries surveys conducted at the Flamingo boat ramps. Similarly, a vast majority of the recreational (sport) angler catch data for Everglades City-Chokoloskee (Lostman's River to the northwestern boundary of ENP) have come from interviews conducted at the Everglades City-Chokoloskee boat ramps and marinas.

During 2005, there were 2008 fishing parties interviewed at Flamingo. About 97% of these

parties were involved in sportfishing activity. Only 6.5% of the anglers did not catch fish. At Everglades City, 1707 fishing parties were interviewed in 2005. Over ninety four percent of the parties interviewed were sportfishing. Only 4.7% of the anglers did not catch fish.

Description of the Fishery (2005)

Most (82.2%) of the anglers fishing out of Flamingo were South Florida residents (Dade County from Homestead, north to Ft. Lauderdale in Broward County, excluding local residents); 2.8% were local residents (Florida City, Flamingo, and the Florida Keys); 13.7% were Florida residents from the remainder of the state of Florida. Only 1.3% of the anglers were from out of state.

Most (83.2%) of the anglers fishing out of Everglades City-Chokoloskee were South Florida residents (Dade and Broward counties), excluding local residents. Florida residents (excluding Dade, Broward, and Collier County residents) accounted for 11.6% of the anglers, while 4% were local (Chokoloskee/Everglades City/Goodland) residents and 1.2% were from out of state.

An estimated 23,863 fishing trips, 58,225 anglers, and 24,687 boats made up the boating and fishing activity in Florida Bay. Of the fishing trips, 8.1% were interviewed at the Flamingo boat ramps. The average trip lasted 7.3 hours with an average fishing time of 6.0 hours and had an average of 2.44 anglers on board.

At Everglades City, an estimated 14,421 fishing trips, 33,906 anglers, and 15,299 boats made up the boating and fishing activity. Of these fishing trips, 11.2% were interviewed at the Everglades City-Chokoloskee boat ramps. The average trip lasted 7.1 hours with an average fishing time of 5.78 hours and had an average of 2.35 anglers on board.

There were an estimated total of 38,284 fishing trips in ENP waters during 2005. This represents a decrease from 45,088 fishing trips estimated in 2004, which was expected with the hurricane events that occurred this year. In other words, since the boat ramps at Flamingo were closed for nearly four months in 2005, there were considerably fewer anglers interviewed at Flamingo this year; therefore the number of fishing trips estimated for the entire park was lower than last year. The overall trend in recreational (sport) fishing trips since 1972 shows high values in 1973-75, lows in 1979-80, and a rebound in the mid-80's to a high value in 1989 (Figure 2). The decline in the estimated number of fishing trips in 1992 is attributed to the impacts of Hurricane Andrew, when ENP was closed from September through December. There was an increasing trend from 1993 until 1997, when the second highest number of fishing trips were recorded in ENP. The estimated number of fishing trips generally remained constant between 1998 and 2000, but showed a large increase in 2001 (Figure 2). The estimated number of fishing trips has been declining since the all-time high in 2001 (Figure 2). Similarly,

the estimated total recreational (sport) fishing effort (estimated total angler-hours) in the park has followed this same general trend from 1972-2005 (Figure 3). Recent declines may be due to three separate park closures in September 2004 and nearly four months of closures at the Flamingo boat ramps in 2005 due to hurricanes events and the clean up efforts in their aftermath. In addition, less boaters and fishermen visited the park this year because they were at home making repairs to their homes and were affected by the rising price of gasoline; therefore some anglers had less money to spend on their normal boating/fishing adventures in the park.

Most anglers interviewed at Flamingo (67%) did not try to catch a specific kind of fish (no preference or were targeting more than one species). Red drum were the most popular fish, sought by 9.6% of the anglers. Snook were targeted by 8.3% of the anglers. The next three most popular species preferred were spotted seatrout (6.7%), tarpon (2.9%), and gray snapper (2.5%). Most (52.2%) of the fishing parties interviewed in 2005 reported catching spotted seatrout in Florida Bay (Figure 4). The next four species most commonly caught in Florida Bay were gray snapper (35.6%), snook (29.9%), red drum (29.5%), and tarpon (4.9%).

Most anglers interviewed at Everglades City-Chokoloskee (62.8%) did not try to catch any particular species of fish. Snook was by far the most popular fish, sought by 29.2% of the anglers. The next four most popular species preferred were spotted seatrout (4.5%), red drum (1.4%), tarpon (0.75%), and gray snapper (0.25%). Approximately 54% of the fishing parties interviewed in 2005 reported catching snook in Area 6 (Figure 4a). The next four species most commonly caught in the lower 10,000 Islands (Area 6) were spotted seatrout (35.6%), red drum (30.7%), gray snapper (23.3%), and tarpon (4.6%).

Relative Abundance (CPUE and HPUE)

Catch rate is a function of the number of fish caught per unit of time (or effort) expended. The number of fish caught for each hour of fishing is used as an index of the abundance of each species of fish. The 2005 mean catch rates (CPUE) and harvest rates (HPUE) for the 11 major species of the recreational (sport) fishery in Florida Bay (Areas 1-5), Everglades City (Area 6), and all of ENP (Areas 1-6) are given in Table 1. Table 2 gives the mean catch and harvest rates of six major gamefish species (snook, red drum, spotted seatrout, gray snapper, tarpon, and bonefish) caught by professionally guided anglers in Florida Bay (Areas 1-5), Everglades City (Area 6), and all of ENP (Areas 1-6). The relationships of 2005 recreational (sport) catch and harvest rates to past years are presented in Figures 5 and 6 for the four major gamefish species (snook, red drum, spotted seatrout, and gray snapper). The relationships of professionally guided catch and harvest rates in 2005 to past years are presented in Figures 7 and 8 for six major gamefish species.

Estimated Total Catch and Harvest

The catches of the interviewed recreational (sport) anglers and the reported catches of the guided anglers are only samples of the total number of fish caught in ENP. Catch rates calculated from interviews are multiplied by the estimated total number of boats fishing for a particular species to yield estimates of total recreational (sport) catch and harvest. For the guided fishery, the total number of fish reported caught/harvested is divided by the percent guide compliance to yield the estimated total catch/harvest by species. The 2005 estimated total recreational (sport) and the professionally guided angler catch/harvest (# of fish) is shown in Table 3. The relationships of 2005 estimated total catch and harvest compared to previous years are shown in Figures 9, 9a, 9b, and 10.

Recent Trends (Florida Bay, Everglades City, and Parkwide as noted)

Overall, there was not a determinable trend in the annual recreational (sport) and professional guide catch rates for snook, red drum, spotted seatrout, or gray snapper for the period of record (Figures 5, 6, 7, and 8). In general, catch rates may be used as an index of abundance and are directly related to environmental factors, but they are not directly affected by fishing regulations. In other words, anglers should be able to catch their desired species at the same rate, regardless of how many fish they are allowed to harvest. Annual harvest rates (which can be affected by changes in the regulations, such as bag limitations) for the three of the four major gamefish species in Florida Bay (Areas 1-5) had been decreasing since the middle to late 1980's, and then held steady in the 1990's and early 2000's (Figures 5 and 7). The decrease in harvest rates for red drum, spotted seatrout, and gray snapper can be directly attributed to decreasing the daily bag limit for each of these species and because of park closures, especially in 2004 and 2005, in the aftermath of the past two hurricane seasons.

Snook

The popularity of snook has increased dramatically in recent years. A number of licensed anglers in Florida have acquired snook stamps, which allows for them to harvest this species of fish. The percentage of recreational (sport) fishing parties catching snook in Florida Bay (Areas 1-5) increased from 9% in 1985 to over 27% in 1994, but suffered a slight decrease through 2000 (Figure 4). The percentage of fishing parties catching snook increased dramatically to 28.1% in 2001, and then slightly decreased to 25.6% in 2002. The percentage increased to an all-time high of 32.3% in 2004 and slightly decreased to 29.9% in 2005. The percentage of recreational (sport) fishing parties catching snook in the Everglades City area (Area 6) since 1995 decreased to a low of 36% in 1998, but rebounded to 44.9% by 2001 (Figure 4a). In 2002, only 40.6% of anglers were catching snook, but this number increased to an all-time high of 55% in 2004. In 2005, there was a similar percentage (54.3%) of anglers catching snook in Area 6.

On January 1, 2002 the fishing regulations for snook changed. The State of Florida (and ENP)

decreased the bag limit from 2 to 1 snook per person per day and indefinitely closed the month of May for harvesting snook in ENP (Monroe County) and the Gulf Coast of Florida. The regulations might have *indirectly* affected the percentage of fishing parties that reported catching snook during the closed season, since perhaps less people were targeting snook at that time of the year. However, these regulation changes in daily bag limits should only affect the harvest rate of snook. The catch rate of snook, after implementing the new regulations has improved, and should continue to improve, since more of the reproductive adult fish will be released during the closed seasons. Therefore, presumably more snook should be recruited into the fishery in the future.

Snook Catch (CPUE) and Harvest (HPUE) Rates:

Catch rates for recreational (sport) anglers in Florida Bay seemed to show a cyclical trend every eight years from 1984-2000 (Figure 5). From the second highest catch rate of 0.337 snook per angler-hour in 1984, the catch rate gradually decreased to 0.171 fish per angler-hour in 1988, only to gradually increase to 0.326 fish per angler-hour in 1992. Another low was reached in 1997 (0.217 fish per angler-hour), and then the catch rate increased yet again in 2000 to a value of 0.297 fish per angler-hour. There were slight decreases in catch rates in 2001-2003, as the trend would predict, however 2004 catch rates reached an all-time high of 0.358 fish/angler-hour, thus breaking the eight-year trend. Although this trend has been broken, the trend of more snook are being caught and released in Florida Bay is increasing. Catch rates for recreational (sport) anglers in ENP (Areas 1-6) have fluctuated since 1990 (Figure 6). While catch rates were at an all-time high of 0.4524 in 2003, the number of snook landed per angler-hour has gradually decreased since 2003 (Figure 6), despite snook having the second highest catch rate for the period of record (0.4232 fish per angler-hour) in 2004. Catch rates in 2005 were slightly lower (0.4051 fish per angler-hour) than the rates in 2004, however they were higher than any other year for the period of record (Figure 6). Guide catch rates have had a general increasing trend since 1980 (Figure 7). Guide catch rates were increasing until 1993, then decreased steadily until 1998. Rates increased again until 2001, then dropped in 2002 and 2003. In 2004, catch rates (0.3531 snook/angler-hour) increased to the highest they have been since 1993, and in 2005 catch rates (0.3809 snook/angler-hour) increased to the highest they have been since 1985 (Figure 7).

Harvest rates for both recreational and professionally guided anglers in ENP have been relatively stable since 1980 (Figures 5-7). Harvest rates by recreational (sport) anglers in Florida Bay dramatically decreased to an all-time low of 0.08 snook per angler-hour in 2002 (Figure 5). This dramatic decrease was primarily due to the new regulations, which allow anglers to harvest one snook/person/day during the open season. The new regulations also call for a new closed season for snook beginning May 1 (instead of June1) and continuing through August 31. Harvest rates for snook in Florida Bay have slightly increased in each of the last three years. Harvest rates for all of ENP (Areas 1-6) were also at all-time lows in 2002 (Figure 6). In 2003, there was an increase in the harvest rate in the park, and the past two years have remained relatively stable (Figure 6). Harvest rates for guided anglers in Florida Bay have

remained fairly stable since 1980 (Figure 7); however it is important to note that the harvest rates for guided anglers made a gradual decline from 1991-2003. Although there has been a general downward trend in harvest rates for guided anglers since 1991, harvest rates were not greatly affected by the new regulations in 2002. While the harvest rate in 2003 (0.0919 fish per angler-hour) was actually the lowest it has been since 1981, the harvest rates have increased in each of the last two years (Figure 7).

These trends have been corroborated by stock assessments conducted by the Florida Marine Research Institute (FMRI, St. Petersburg) using state and federal recreational fishery statistics (Muller and Murphy, 2001). The increases may reflect stock recruitment of small juvenile snook, which were released in prior years because of size restrictions and were recruited to the fishery four years later; that is the time needed for snook to recruit to the park fishery (Thue et al, 1982). Snook are a relatively non-migratory, inshore species that will make localized movements between estuaries as juveniles and move to nearby offshore areas as adults for spawning. Recruitment may also be enhanced by increased rainfall and/or runoff. In addition, a collaborative project with FMRI, pertaining to monthly mean catch rates of snook in ENP (Areas 1-6) have been analyzed using general additive and linear regression statistical models for trend analysis to detect long-term changes in the catch rate. State and park-wide stock assessment results are forthcoming in 2006.

Snook Estimated Total Catch & Harvest:

The estimated total catch for snook by recreational (sport) anglers in Florida Bay (Areas 1-5) has shown a general increasing trend since 1985 (Figure 9). Despite great fluctuations in recent years, there has been an increasing trend since a low of 14,093 fish in 1999. There have been some impressive numbers for the estimated total catch in 2003 and 2004 (27,403 fish and 35,521 fish, respectively), but in 2005 the total estimated catch decreased to 24,156 fish (Figure 9). Recreational (sport) angler estimated total harvest in Florida Bay has remained relatively stable throughout the period of record, despite the new bag limit restrictions that were initiated on January 1, 2002 (Figure 9). Since more anglers are targeting the species than ever before, then this would indicate that the Florida Bay stocks might have been overfished in the recent past (Muller and Murphy, 2001). On the other hand, an analysis of total catch and harvest estimates for Areas 1-6 (Figure 9a) and Area 6 (Figure 9b) in the most recent years (1998-2005) has shown a general increase in total catch (excluding 2002 and 2005) and stable numbers in total harvest for snook. In the year that the new regulations were implemented (2002), there were decreases in both total catch and total harvest estimates for Areas 1-6 (Figure 9a) and Area 6 (Figure 9b). There were slight increases in total catch and harvest for recreational anglers in 2003 and 2004, then there was a decrease in 2005 (Figures 9a and 9b). In 2004, total catch estimates for all areas (Areas 1-5, Areas 1-6, and Area 6) showed the highest numbers for the period of record (Figures 9, 9a, and 9b). Estimated total catch and harvest for guided anglers in Florida Bay had been increasing since 1990, but then dropped after all-time highs in 1995 (Figure 10). While the guided angler total catch estimates have been fluctuating in recent years, total harvest estimates for guided anglers have been steadily

decreasing since 2000. The data for 2005 reflected the lowest estimated total harvest numbers (341 snook) in Florida Bay for the period of record (Figure 10). This low estimate could be an indication that more guides are enforcing a "catch and release" policy for all snook, not for just those outside the 26"-34" slot size. In addition, the low total harvest estimates for professionally guided anglers fishing for snook could be attributed to the prolonged park closures in 2004 and 2005 due to hurricane-related events.

Red Drum

The percentage of recreational (sport) fishing parties catching red drum in Florida Bay (Areas 1-5) has fluctuated throughout the period of record, with percentages ranging from 17.3% in 1988 to 36% in 1997 (Figure 4). The percentage of anglers catching red drum decreased dramatically from 33% in 1985 to 17.3% in 1988 when the fishery was closed due to overexploitation (Figure 4). When harvest of red drum was reopened, the percentage of anglers catching the species increased steadily to a 13-year high of 36% in 1997 (Figure 4). While the percentages of anglers catching drum continued to drop to 27.2% in 2000, there was a significant increase in 2001, and they have only slightly decreased in each of the past four years. The percentage of fishing parties catching red drum in Everglades City (Area 6) gradually declined between 1995 (a high of 36%) and 2000 (a low of 24.6%), followed by an increasing trend for the next four years (Figure 4a). The percentage of anglers catching red drum at Everglades City only slightly dropped to 30.7% in 2005 (Figure 4a).

Red Drum Catch (CPUE) and Harvest (HPUE) Rates:

Recreational (sport) angler catch rates in Florida Bay decreased from 1980 to 1982 and then increased in the next two years, followed by catch rates dropping considerably until a low in 1988 (Figure 5). Catch rates have remained fairly stable since 1989. There was a low catch rate of 0.290 fish per angler-hour in 1994, but then rates increased to 0.384 fish per angler-hour in 1998. Since the fishery recovered faster than anticipated, the Florida Marine Fisheries Commission (FMFC) allowed year-round harvesting of red drum in 1996, which may explain the slightly higher catch rates in the late 1990's (Figure 5). There was a slight decrease in catch rates for each year since 1998 from 0.370 fish per angler-hour in 1999 to an all-time low of 0.2724 fish per angler-hour in 2002 (Figure 5). In 2003, there was an increase, but catch rates for the past two years have been relatively low, so we will closely monitor them for the next few years. Recent recreational (sport) angler catch rates for Everglades City (Area 6) are not as high as they were in the early 1990's (Figure 6). Catch rates remained relatively constant from 1995 to 1998, but there has been a general downward trend in catch rates since (Figure 6). The professional guide catch rates were steadily declining between 1985 and 1995 (Figure 7). From 1994-2005, an interesting four-year trend has become evident (Figure 7). The first two years of this twelve-year period have similar guide catch rates, followed by increasing rates in the next two years (Figure 7). For example, in 1994 and 1995, there were similar rates, followed by increasing rates for 1996 and 1997. Catch rates dropped in 1998 and rates were similar in 1999, followed by increases 2000 and 2001 (Figure 7). The same trend occurred in the next four years; however catch rates in 2003 reflected an all-time low of 0.369 fish per

angler-hour, while 2004 and 2005 catch rates have shown significant increases of 0.4364 fish per angler-hour and 0.4786 fish per angler-hour, respectively (Figure 7).

Red drum harvest rates for recreational (sport) anglers in Florida Bay (Figure 5) and in all of ENP (Figure 6) have remained quite stable since 1989, when the bag limit of 1 fish per person/day was imposed. The harvest rates for recreational anglers in Florida Bay from 1980 to 1986 were much higher than the rates we have seen since then. For example, harvest rates for red drum in 1984 were 0.5484, which is more than five times the rate of 0.1095 in 2005 (Figure 5). Guide harvest rates in Florida Bay also have been quite stable since the 1988 red drum closure (Figure 7). Increased minimum size limits (from 12" to 18") and a closed season imposed on the fishery in September 1985 probably accounted for the large declines in harvest rates between 1985 and 1987; however, the sharp decline during 1985 suggests the possibility of overharvest or poor recruitment (Figures 5 and 7).

Red Drum Estimated Total Catch & Harvest:

Annual estimated total catch data from recreational (sport) anglers suggest that red drum catches in Florida Bay had been steadily increasing from 1988 until an all-time high of an estimated 45,979 fish caught in 1997 (Figure 9). Since 1997, there were large decreases in total catch in 1998, 1999 and 2000 (Figure 9). The estimated total catch of red drum has fluctuated for the last five years, but total catch estimates in 2001 were the second highest for the period of record (43,656 fish). There has been a downward trend since 2003, with the estimated total catch of 24,533 red drum in 2005 being the lowest it has been since 1990 (Figure 9). The trend for estimated total harvest in Florida Bay for the period of 1997-2004 shows a 4-year cyclical trend, beginning with high harvest rates for the first year, followed by three years of declining harvest rates (Figure 9). The estimates for 2005 did not follow that trend, however the 2005 hurricane season could have contributed to this continued downward trend (Figure 9). Total estimated harvest of red drum in Florida Bay by guided anglers showed a slow, but steady increasing trend from 1990 to 1998, and has had a slight downward trend since 1998, with 2004 (804 fish) having the lowest estimates since 1991 (Figure 10). The total estimated harvest of red drum only slightly increased in 2005 to 862 fish (Figure 10). Similarly, the estimated total catch for guided anglers increased from 1990 until 1997 and has gradually declined since 1997, with 2004 (10,505 fish) having the lowest estimates since 1991 as well (Figure 10). The total estimated catch of red drum in Florida Bay slightly increased in 2005 to 12,660 fish (Figure 10).

An analysis of the estimated total catch of red drum by recreational (sport) anglers in all of ENP (Areas 1-6) showed a gradual decrease in 1998-2000, followed by a significant increase in 2001 (Figure 9a). There was a significant decrease in 2002, however total catch estimates in 2003 and 2004 increased. The total catch estimate for red drum for all of ENP in 2005 (33,440 fish) was the lowest it has been for the period of record (Figure 9a). The total harvest estimates follow these trends as well, but there has been a downward trend since 2001, with the 2005 estimate (7,293 fish) being the lowest it has been for the period of record (Figure 9a).

For Everglades City (Area 6), there were similar trends in the estimated total catch and total harvest of red drum between 1998 and 2005 as well (Figure 9b). While total catch (highest for period of record) and harvest (second highest for period of record) estimates in 2004 increased in Everglades City (Figure 9b), the 2005 estimates were lower than in recent years. For example, the estimated total catch for red drum in Everglades City in 2005 was 8,908 fish (the lowest estimate since 2000), and the total harvest estimate was 2,961 fish (the lowest estimate since 2002) (Figure 9b).

Spotted Seatrout

The percentage of fishing parties interviewed at Flamingo (Areas 1-5) catching spotted seatrout declined slightly from 1985-1989, but increased sharply to a 21-year high of almost 61% in 1992 (Figure 4). Since then, the percentage of anglers catching seatrout declined to an all-time low of 39% in 1996 (Figure 4). There was an increasing trend between 1996 and 2000, when seatrout were being caught by over 58% of the recreational (sport) anglers. From 2000 to 2003 there were dramatic decreases in the percentage of fishing parties catching seatrout, however these percentages have increased in the past two years (Figure 4). The percentage of fishing parties interviewed at Everglades City (Area 6) that were catching spotted seatrout since 1995 has not shown a significant trend and ranges between 30% (1995) and 42.9% (2000) (Figure 4a). As with anglers fishing out of Flamingo, there has been a general decreasing trend for fishing parties catching seatrout out of Everglades City from 2000 to 2004 (Figure 4a). The percentage in 2004 (30.2%) was the lowest it has been since 1995 (30.2%), however the 2005 percentage increased to 35.6% (Figure 4a). Fishing regulations on seatrout may have affected overall angler strategy. The declining trend in targeting seatrout fishing is most likely associated with increases in anglers targeting red drum and snook. Anglers in recent years might have switched their target preferences to the latter two species. As a result of more anglers fishing for red drum and snook, successful catches for seatrout increased for those anglers that continued to prefer targeting seatrout. The changes in the size and number of seatrout that could be harvested might have contributed to this trend.

Spotted Seatrout Catch (CPUE) and Harvest (HPUE) Rates:

The lack of increase in harvest rate associated with an increase in catch rate may be due to state regulations that were imposed on the seatrout fishery in 1989 which raised the legal size limit from 12" to 14", and then for the South Florida populations to 15" in 1996 (Figure 5). These regulations were meant to reduce the harvest of seatrout to achieve the FMFC's spawning potential ratio (SPR) objective of 35%. The SPR is the ratio of the spawning stock biomass of the exploited (or fished) population to the spawning stock biomass of the same population in an unfished condition.

The catch rate for recreational (sport) anglers in Florida Bay has fluctuated throughout the period of record, however significant decreases in catch rates in 2001 (0.8395 fish/angler-hour) and 2002 (a 23-year low of 0.6835 fish/angler-hour) have been noted (Figure 5). While the catch rate slightly increased to 0.7003 fish per angler-hour in 2003, the catch rate decreased to

an all-time low of 0.6737 fish per angler-hour in 2004 (Figure 5). Juvenile spotted seatrout studies (A. Powell, NOAA, pers. comm.), conducted in Florida Bay since the mid-1990's, have indicated cycles of juvenile density/abundance in western Florida Bay corresponding to changes in recreational sportfishing CPUE of spotted seatrout. Preliminary juvenile spotted seatrout data from western/central Florida Bay suggested density declines during 2003, which are in conjunction with the park's recreational catch declines (Figure 5). Due to these low catch rates, fisheries personnel will continue to review these data to see if there is a concern for making any adjustments in the closed season, bag limit, or size restrictions. The catch rate of seatrout in all of ENP (Areas 1-6) has fluctuated since 1990; however since 2000 four of the last five years have had lower catch rates than any of the years for the period of record (Figure 6). The harvest rate for spotted seatrout in Areas 1-6 has also followed this trend since 2000 (Figure 6).

Recreational (sport) angler harvest rates for spotted seatrout had been holding steady since 1990 in Florida Bay (Figure 5) and in all of ENP (Figure 6); however there was a decreasing trend from 2001 until 2004. Catch and harvest rates in both areas of the park increased in 2005 (Figures 5 and 6). Professional guide harvest rates, on the other hand, have been gradually decreasing since 1982; yet, guide catch rates have been fluctuating over the same time period (Figure 7).

Spotted Seatrout Estimated Total Catch & Harvest:

The estimated total catch of seatrout in Florida Bay has been fluctuating for the period of record, with highs in 1990 (166,288 fish) and 2000 (172,966 fish). The total catch estimates were at an all-time high in 2000, but these impressive numbers have been followed by a dramatic decline through 2005 (Figure 9). Similarly, the 1990 highs were followed by six years of total estimated catch declines (Figure 9). Annual estimated total harvest data from recreational (sport) anglers in Florida Bay suggest that seatrout total harvest decreased steadily from 1989 to 1996 (Figure 9). Since 1996, the estimated number of fish harvested has remained relatively stable; however, in 2003, there was an all-time low of 18,217 fish (Figure 9). The estimated total harvest only slightly increased to 19,435 fish in 2004 and to 22,192 fish in 2005 (Figure 9). The estimated total catch and harvest for all of ENP (Areas1-6) and Everglades City (Area 6) between 1998 and 2004 showed gradual increases through 2000, followed by significant decreases for the next three years (Figures 9a & 9b), culminating with record lows for estimated total catch and harvest in 2003. Estimated total catch and harvest for Areas 1-6 (Figure 9a) and Area 6 (Figure 9b) have increased slightly or leveled off in the past two years. The estimated total catch of spotted seatrout by professionally guided anglers in Florida Bay was showing a general increasing trend from 1990 (excluding 1996 when new regulations were implemented) to 2000 (Figure 10). The total catch estimate in 2000 was at an all-time high of 103,098 fish (Figure 10). However, there has been a general downward trend since 2000, with the 2004 total catch estimate (41,739 fish) being the lowest it has been since the 1996 all-time low (Figure 10). Total catch estimates increased slightly to 52,072 fish for guided anglers in 2005. Estimated total harvest from professionally guided anglers in Florida

Bay had been very stable from 1990-1995, but experienced a low of 6,395 fish in 1996 (Figure 10). From 1996-2000, the spotted seatrout estimated total harvest rebounded to 16,002 fish in 2000, but decreased in the subsequent four years to an all-time low of 3,116 fish in 2004 (Figure 10). Total harvest estimates increased slightly to 4,204 fish for guided anglers in 2005.

Gray Snapper

The percentage of fishing parties reporting catches of gray snapper in Florida Bay has remained relatively stable from 1985-2005 (Figure 4). The large decline seen in 1991 was probably due to new regulations (in 1990) that established the minimum size at 10" with a daily bag limit of five fish per person. The percentage of anglers catching gray snapper increased from 29% in 1997 to nearly 38% in 1999. In 2000 there was an all-time low of 27.9% of fishing parties catching gray snapper, but there was an increasing trend for the next three years, with 2003 reflecting the third highest level (43.4%) for the period of record (Figure 4). The percentage of anglers catching gray snapper has slightly decreased in each of the last two years (39.1% and 35.6%, respectively) (Figure 4). The percentages of fishing parties interviewed at Everglades City (Area 6) that were catching gray snapper have remained very stable since 1995 (Figure 4a). In 2003, there was an all-time high of 26% of fishing parties that were catching gray snapper, followed by slight decreases in 2004 and 2005 (Figure 4a).

Gray Snapper Catch (CPUE) and Harvest (HPUE) Rates:

Catch rates for both guided and recreational (sport) anglers have been fluctuating through the period of record (Figures 5, 6, and 7). After steady declines from 1980 to 1987, there were slight increasing trends in Florida Bay for the next two years, followed by downward trends in the 1990's (Figures 5 and 7). From 1992 to 1998, there was a general downward trend in catch rates. Then the catch rates increased to 0.892 fish per angler-hour in Florida Bay in 1999, decreased in 2000 and 2001, increased in 2002 and 2003, and have remained stable for the past two years (Figure 5). From 1988-1992, the increases in catch rate, and decreases in the harvest rates, may reflect a good recruitment of small juvenile fish to the stock. Perhaps the large increase in catch rate in 1999 was also related to good recruitment. In general, harvest rates for recreational (sport) and professionally guided anglers in Florida Bay (Areas 1-5) for gray snapper had shown steady declines from 1980 until the middle to late 1990's, however they have leveled off and remained relatively stable since (Figures 5 and 7). In 2003, the harvest rate for recreational (sport) anglers in Florida Bay was the highest it had been for 11 years (0.3617 fish per angler-hour) and has only slightly decreased in 2004 and 2005 (Figure 5). Similarly, harvest rates for recreational anglers in the entire park (Areas 1-6) were also at an 11-year high in 2003, however have slightly decreased in each of the past two years (Figure 6). In addition, harvest rates (0.7517 fish per angler-hour) in 2004 for professionally guided anglers fishing in Florida Bay were the highest they have been since 1990, and in 2005, harvest rates only slightly decreased to 0.6923 fish per angler-hour (Figure 7).

Gray Snapper Estimated Total Catch & Harvest:

During the middle to late 1990's, the annual recreational (sport) and guided angler estimated

total catch and total harvest for gray snapper in Florida Bay dropped as low or lower than anytime during previous records (Figures 9 and 10). The decreasing total harvest estimates in the early to mid-1990's are probably due to the regulations that were imposed on the fishery in 1988 and 1990 when the legal minimum size was increased from 6" to 8", and then to 10" with a daily bag limit of 5 gray snappers per person. Total harvest estimates since 1997, in general, have had an increasing trend in Florida Bay until 2003 (Figures 9 and 10). The 2003 harvest estimate (31,536 fish) was the highest it has been since 1990 for recreational anglers and since 1995 (6,647 fish) for guided anglers. In the past two years, harvest estimates have remained stable for the guided anglers (Figure 10); however the estimates for recreational (sport) anglers have greatly decreased to an all-time low of 10,460 fish in 2005 (Figure 9). The estimated total catch for gray snapper in Florida Bay has fluctuated greatly for the period of record (Figure 9). The estimated total catch should mimic a 3-year trend because gray snappers in Florida Bay take approximately 3-4 years to be recruited into the fishery. However, the data do not support this trend. The two highest total catch estimates for recreational (sport) anglers in Florida Bay were in 1989 and 1990 (123,707 fish and 122,337 fish, respectively) (Figure 9). The 1990's witnessed a slight upward trend in total catch after the 1991 crash in total catch estimates. In 2000, there was another significant decrease, followed by three years of increasing total catch estimates (Figure 9). Total catch estimates in 2004 and 2005 have decreased dramatically (Figure 9). Estimated total catch and harvest throughout all of ENP (Areas 1-6) gradually decreased from 1998 to 2000 (Figure 9a), then there was a general increasing trend from 2001 to 2003. In 2003, both total catch and total harvest estimates were at the highest levels (142,044 fish and 31,858 fish, respectively) for the period of record (Figure 9a). The total catch and harvest estimates have slightly decreased in each of the past two years (Figure 9a). The estimated total catch and harvest of gray snapper in Everglades City (Area 6) showed a marked decrease from 1998 to 1999 (Figure 9b). While the estimated total catch has remained relatively stable since 2000, the total harvest estimates have greatly fluctuated (Figure 9b). The estimated total harvest increased from a low of 529 fish in 1999 to an all-time high of 5,197 in 2001, then plummeted to an all-time low of 322 fish in 2003 (Figure 9b). While the total harvest estimates in Everglades City rebounded to 4,052 fish in 2004 (the second highest estimate for the period of record), estimates dropped to 1,886 fish in 2005 (Figure 9b). The estimated total harvest of gray snapper in Everglades City in 2003 was extremely low, so we will be doing further analyses with the data to determine the causes for these estimates. There might be a problem with the way that the estimates are figured or the low estimates could have been attributed to a simple a data entry or data loading error. We will continue to work on perfecting these estimates in future annual reports. The "Aerial Survey of Boater Use in Everglades National Park Marine Waters" project may provide us with new, updated information, as well as insight into more realistic estimates for total catch and harvest estimates.

Tarpon & Bonefish Catch and Harvest Rates (Guide)

The professional guide fishery is largely directed at a few highly prized gamefish species. Two of

these species, tarpon and bonefish, are of little food value and are not sought by the majority of the recreational (sport) anglers. They are the trophy species of the guide fishery. Since harvest of tarpon and bonefish occurs mainly for the purposes of having the fish professionally mounted by a taxidermist, harvest rates are not accurate indicators of population densities for these two species and are not included in this report. However, catch rates are more indicative of their stocks than harvest rates.

Tarpon

The harvest rates for tarpon, if included in this report, might be misleading to most readers of this report because when following the procedures used by Malvestuto (1983) to calculate HPUE, the procedures focus on only including data from anglers that harvested of the fish. If this statistic included the effort expended by anglers that "catch and release" their tarpon, then the harvest rate would be much lower. Since very few tarpon are harvested each year, the harvest rates used to calculate the HPUE for the year usually only include one or two reports. Consequently, those few reports are all we have to conduct the analysis, and the resultant HPUE might not be indicative of the "true" harvest rate for tarpon in Florida Bay. For example, a rate of 0.1 fish harvested per angler-hour indicates that 1 fish is harvested for every 10 hours of effort that anglers expend. This is not realistic because, for example, there might have only been one or two tarpon harvested for the entire year by all guided anglers within the fishery when perhaps thousands of hours were spent fishing for them. With the amount of effort that is expended by guided anglers fishing for tarpon in Florida Bay, it is unrealistic to think that literally hundreds of tarpon are being harvested.

The catch rate of tarpon rebounded in 1983, from a low of 0.1789 fish per angler-hour in 1982, but experienced a slow decline in the mid-1980's reaching another low of 0.1701 fish/angler-hour in 1987 (Figure 8). The catch rates of tarpon increased to an all-time high of 0.2543 fish per angler-hour in 1995, and then leveled off around a somewhat lower CPUE of approximately 0.2 fish per angler-hour from 1996 to 2003 (Figure 8). Catch rates decreased to an all-time low of 0.168 fish per angler-hour in 2004, then increased slightly to a rate of 0.1837 fish per angler-hour in 2005 (Figure 8).

Bonefish

Like tarpon, bonefish are not harvested unless the angler desires to have the fish professionally mounted by a taxidermist. Bonefish catch rates for guided anglers in Florida Bay (Areas 1-5) were steadily declining from 1981 to 1983, followed by a steady increase through 1988 (Figure 8). Professional guide catch rates for bonefish reached an all-time high in 1994 (0.4011 fish per angler-hour). Then there was a gradual decline from 1995 to 2000 (Figure 8). Since an all-time low of 0.2308 fish per angler-hour in 2000, catch rates for bonefish have fluctuated around 0.25 fish per angler-hour since (Figure 8). It is interesting to note that from 1990 until 2001, catch rates seemed to be on a 4-year cyclical trend (Figure 8). However, the past four years have not followed this trend. Nearly all bonefish are caught in Area 2 of Florida Bay (Figure 1), and they are usually always released when caught; therefore, it is highly unlikely that fishing

mortality has played a significant role in determining bonefish stock abundance. As with the harvest rates for tarpon, the harvest rates for bonefish, if they were to be included in this report, only represent a minimal number of reports throughout the period of record. Harvest rates for bonefish were not included in this analysis because we found that they do not reflect a "true" harvest rate for all guided anglers within Florida Bay (see above). Recently, Dr. Jerry Ault of University of Miami, RSMAS, conducted an annual census of bonefish in and adjacent to the park's southern boundary in cooperation with Florida Keys guides to identify population changes in South Florida. Preliminary results suggest different species of bonefish exist in the extreme South Florida area.

Estimated Total Catch for Tarpon and Bonefish: The annual estimated total catch (and harvest) of tarpon and bonefish for guided anglers in 2005 is given in Table 3. The estimated total harvest for tarpon and bonefish would normally be zero, however there was one record of a harvested tarpon this year, so that estimate was projected in this table and resulted in an estimated three tarpon harvested in Florida Bay and all of ENP this year (Table 3).

Fish Lengths (2005)

Fish measured for this analysis were measured differently than anglers measure their fish for purposes of harvesting a legal-sized fish. The four species measured for these analyses were snook, red drum, spotted seatrout, and gray snapper, all of which are to be measured by total length (TL) for fishing regulations. TL is taken by measuring the fish from the tip of its snout (with the mouth closed) to the furthest edge of its caudal fin (tail). However, for the following graphs in Figures 11-15, the snook, red drum, and gray snapper were actually measured by fork length (FL). FL is taken by measuring the fish from the tip of the snout (with the mouth closed) to the fork (or middle) of the tail. The three species for these analyses have been measured this way in the past reports, so we will continue to measure the fish this way to be consistent. Also, when looking at Figures 11-15, the small number (N=) represents the number of fish measured for that particular sample. The larger number below this row of numbers represents the Fishing Area (see Figure 1) where the fish were caught.

Snook

A comparison of mean lengths of snook harvested by recreational (sport) anglers in Areas 1, 3, 4, 5, and 6 of ENP showed that there was not a significant difference in mean lengths among the five areas in 2005 ($F_{4, 234} = 1.117$, $p = 0.349$) (Figure 11). Area 2 was eliminated from this analysis because there was only 1 snook harvested from that area of ENP. Post hoc tests require that at least one group (Area 2 in this instance) have more than 1 case. In another analysis, the lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of snook harvested in Florida Bay (Areas 1-5) versus Everglades City (Area 6). For 2005, there was no difference in mean snook length between Florida Bay and Everglades City ($F_{1, 237} = 0.192$, $p = 0.661$) (Figure 12).

A parkwide seasonal comparison of snook lengths for 2005 also showed that there was not a significant difference among the four seasons ($F_{3, 235}$ =1.697, p=0.168) (Figure 13). A comparison of snook lengths from Florida Bay only (Areas 1-5) also showed that there was not a significant difference in the lengths of harvested fish among the four seasons ($F_{3, 138}$ =1.582, p=0.196) (Figure 14). In addition, there was no significant difference ($F_{3, 94}$=0.380, p=0.768) in the lengths of snook harvested exclusively within Area 6 (Everglades City) among the four seasons (Figure 15).

Red Drum

There was a significant difference in the mean lengths of red drum harvested among the six areas of ENP during 2005 ($F_{5, 492}$=3.628, p=0.003) (Figure 11). On average, using a Tukey's Multiple Comparison test, red drum harvested from Area 1 were significantly longer than the red drum harvested from Areas 3 (Figure 11). Since only three fish from Area 2 were harvested, the comparison test did not identify any significant differences in lengths when comparing them to fish harvested from other areas. In another analysis, the lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of red drum harvested in Florida Bay (Areas 1-5) versus Everglades City (Area 6). In 2005, there was not a significant difference ($F_{1, 496}$ =0.269, p=0.604) in the lengths of red drum harvested in Florida Bay versus Everglades City (Figure 12).

A seasonal comparison of red drum lengths collected parkwide (Areas 1-6) showed that there was not a significant difference in the lengths of red drum in 2005 ($F_{3, 494}$ =0.834, p=0.476) (Figure 13). The lengths of red drum harvested in Florida Bay only (Areas 1-5) did show significant seasonal differences ($F_{3, 272}$ =2.650, p=0.049) (Figure 14). On average, using a Tukey's Multiple Comparison test, red drum harvested in the winter were significantly longer than the red drum harvested in the fall (Figure 14). Red drum harvested in Everglades City (Area 6) did not show significant differences among seasons ($F_{3, 221}$ =0.100, p=0.960) (Figure 15).

Spotted Seatrout

In 2005, there were not any significant differences in the mean lengths of harvested spotted seatrout at the 95% confidence intervals among the six areas of ENP ($F_{5, 1460}$ =2.145, p=0.058), however there was a significant difference at the 90% confidence interval (Figure 11). This confidence interval of 90% is also commonly statistically acceptable. Using a Tukey's Multiple Comparison test, harvested spotted seatrout in Area 4 were significantly longer than those from Area 1 (p=0.070) (Figure 11). In another analysis, when the lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of spotted seatrout harvested in Florida Bay (Areas 1-5) versus Everglades City (Area 6) during 2005, there was not a significant difference ($F_{1, 1464}$=0.251, p=0.617) (Figure 12).

There was a significant difference in the mean lengths of spotted seatrout harvested parkwide (Areas 1-6) among the four seasons of 2005 ($F_{3, 1462}$ =5.596, p=0.001) (Figure 13). Using

Tukey's Multiple Comparison test, spotted seatrout harvested in the spring were significantly ($p<0.0001$) longer than those harvested in the winter (Figure 13). A seasonal comparison of spotted seatrout harvested only in Florida Bay (Areas 1-5) also showed that there was a significant difference in the lengths of seatrout harvested among the four seasons of the year ($F_{3, 896} =5.549$, $p=0.001$) (Figure 14). By using Tukey's Multiple Comparison test, we also determined that seatrout harvested in the spring were significantly ($p<0.0001$) longer than those harvested in the winter (Figure 14). There was not a significant difference found in the lengths of spotted seatrout harvested in Everglades City (Area 6) during the four seasons of 2005 ($F_{3, 593} =1.090$, $p=0.353$) (Figure 15). For Figures 14 and 15, there were not many fish were measured in the Fall because spotted seatrout are have a closed season during November and December; therefore the number of fish measured in the Fall were not sufficient to include in these two analyses.

Gray Snapper

In 2005, there was a significant difference in the lengths of harvested gray snapper among the six areas of ENP ($F_{5, 504}=13.788$, $p<0.0001$) (Figure 11). Using Tukey's Multiple Comparison test, it was determined that gray snapper harvested in Area 2 were significantly longer than those harvested from Areas 1, 3, 4, and 6 (Figure 11). In addition, gray snapper that were harvested in Area 5 were significantly longer than those harvested in Areas 1, 3, 4, and 6 (Figure 11). In another analysis, the lengths for Areas 1-5 were pooled together to determine if there was a difference in the lengths of gray snapper harvested in Florida Bay versus Everglades City (Area 6). Indeed, gray snapper harvested from Areas 1-5 were significantly longer than those harvested in Area 6 ($F_{1, 508} =12.333$, $p<0.0001$) (Figure 12).

In the parkwide (Areas 1-6) analysis there was a significant difference in the lengths of gray snapper harvested among the four seasons in 2005 ($F_{3, 506} =6.858$, $p<0.0001$) (Figure 13). Using Tukey's Multiple Comparison test, snappers harvested in the spring were significantly longer than those harvested in the winter, summer, and fall (Figure 14). The lengths of gray snapper harvested in Florida Bay only (Areas 1-5) were also significantly different among the four seasons ($F_{3, 373} =14.454$, $p<0.0001$) (Figure 14). Using Tukey's Multiple Comparison test, snappers harvested in the winter were significantly longer than those harvested in the summer (Figure 14). In addition, snappers harvested in the spring were significantly longer than those harvested in the summer and fall (Figure 14). Harvested gray snapper in Everglades City (Area 6) showed significant seasonal differences in lengths during 2005 ($F_{3, 129} =8.262$, $p<0.0001$) (Figure 15). Using the multiple comparison test, gray snappers harvested in the summer were significantly longer than those harvested in the winter, spring, and fall (Figure 15). In addition, gray snappers harvested in Area 6 in the springtime were significantly longer compared to those harvested in the winter (Figure 15).

Environmental Relationships

Catch rates can be directly related to environmental factors such as rainfall, water level, and

salinity. In addition, catch rates can be influenced by natural phenomena such as cold snaps and freezes. The catch rates for recreational (sport) anglers in Areas 1-5 were correlated with rainfall, water level, and salinity from 1985-2005 (Figures 16-19). Total annual rainfall from 1985-2005 was compiled and averaged from five stations within or near ENP (Flamingo, Royal Palm, Everglades City, Tamiami Ranger Station (Forty Mile Bend), and Tavernier (Butternut Key has replaced Tavernier since 1997)). These five rainfall stations are a regional representation of rainfall within ENP. Watson Place has replaced Everglades City rainfall station, and Terrapin Bay replaced the Flamingo rainfall station in 2005. Terrapin Bay was the closest station to Flamingo that was not destroyed by the 2005 hurricanes. The hurricanes of 2005 also destroyed monitoring stations at Joe Kemp Key, Garfield Bight, and Whipray Basin. Water level data from 1985-2005 were obtained from well P-37 in western Taylor Slough (an area roughly due north of Area 1). Salinity data from 1985-2005 were obtained from three stations in the northeastern areas of Florida Bay (Areas 1E and 2E), which include Taylor River, Trout Cove, and Butternut Key.

Snook

The declines in snook stocks (or catch rates) from 1985-1988 may have been due to low rainfall and water levels in the upper marsh regions of ENP (Figure 16). However, there was not a significant correlation between water levels recorded and catch rates from 1985-2005 ($r=0.162$, $N=21$, $p=0.482$); this same result was obtained last year as well when data from 1985-2004 were analyzed. Although, no statistically significant correlations were found, the trends in Figure 16 suggest that a period of generally high salinity ($r=-0.113$, $N=21$, $p=0.625$) leads to a decline in the catch rate (or abundance) of snook. Field studies on snook habitat have shown that the greatest numbers of juveniles are consistently found in shallow, well protected, back-water areas of estuaries that are influenced by freshwater runoff (Fore and Schmidt 1973; McMichael et al. 1987). In addition, no significant correlation was found between rainfall and snook catch rates ($r=0.096$, $N=21$, $p=0.678$).

Red Drum

The reduced abundance (or catch rates) of red drum during the late 1980's and mid-1990's may have been due to a combination of prior intense fishing pressure and increased rainfall (Figure 17). Previous studies (Higman, 1967) have shown that low rainfall may lead to an increase in the abundance of juvenile red drum. However, no statistically significant relationships were found between red drum catch rates and any of the environmental variables from 1985-2005. Similarly, there were no significant correlations last year when data from 1985-2004 were analyzed. There was not a statistically significant relationship between the red drum catch rates and salinities from 1985-2005 ($r=0.330$, $N=21$, $p=0.145$). In addition, red drum CPUE did not correlate with rainfall or water levels either ($r=-0.331$, $N=21$, $p=0.143$ and $r=-0.203$, $N=21$, $p=0.377$, respectively).

Spotted Seatrout

From 1988 to 1990, the salinity increased to a high level, while seatrout catch rates increased

concurrently (Figure 18). This trend suggests that periods of high salinity lead to increased abundance of spotted seatrout. However, the trend was not witnessed for the entire period of record (1985-2005). In fact, there was not a statistically significant relationship between spotted seatrout catch rates and salinity ($r=0.249$, $N=21$, $p=0.276$). Similarly, rainfall and water levels also had no correlation with seatrout CPUE ($r=-0.112$, $N=21$, $p=0.629$ and $r=-0.149$, $N=21$, $p=0.519$, respectively). These are the same results as last year when environmental parameters were correlated with CPUE's from 1985-2004. However, previous studies have suggested that increased rainfall/water levels improve spotted seatrout recruitment through increased growth and survival of larvae and juveniles (Thayer et al. 1998). Presumably an increase in coastal rainfall (and thus lower salinities) results in an increase in larval recruitment and/or juvenile seatrout survival (Rutherford et al. 1989a).

Gray Snapper

Overall (1985-2005), a positive significant ($r=0.538$, $N=21$, $p=0.012$) relationship was found between catch rates of gray snapper and mean annual salinities found in northeastern Florida Bay (Figure 19), suggesting that periods of high salinity lead to increased abundance of gray snapper. Average annual water levels recorded at P-37 were significantly inversely related to gray snapper catch rates during the same years ($r=-0.563$, $N=21$, $p=0.008$), indicating that during periods of reduced water levels in the upper Taylor Slough, the abundance of gray snapper increased. However, rainfall was not significantly correlated with gray snapper catch rates for the period of record ($r=-0.356$, $N=21$, $p=0.114$). Similar correlation results were obtained last year when data from 1985-2004 were analyzed. This leads to the theory that increases in gray snapper abundance may be related to low yearly rainfall in the ENP area and periods of high salinities in Florida Bay. A series of low rainfall years from 1985-1990 resulted in increased hypersaline conditions in Florida Bay (Figure 19). Rutherford et al. (1983) reported larger fish in areas of higher salinity. Thus, if during low rainfall years, sub-adult fish remain in Florida Bay longer under high salinity conditions, then gray snapper abundance (catch rates) should increase, and gray snappers would become increasingly available to anglers. From 1990 to 1995, there was an overall increasing trend for water levels and rainfall, and notably high levels from Tropical Storm Gordon in November 1994, resulting in salinity reductions in northeastern Florida Bay and decreases in gray snapper catch rates in 1991, 1993, and 1994 (Figure 19).

Catch-Effort Relationships

It is not always sufficient to know if declining catch rates are indicative of a fishery that is in trouble. If both total estimated catch and catch rates are in decline, then there is a need to assess the amount of effort being placed on the fishery. In Figure 20, the estimated total catch and estimated total effort of the four major species (snook, red drum, spotted seatrout, and gray snapper) in Florida Bay (Areas 1-5) have been correlated to determine if fishing effort is impacting the stocks.

Snook

An estimate of annual fishing effort of recreational (sport) anglers catching snook in Florida Bay ranged a low of 26,775 angler-hours in 1985 to an all-time high of 148,711 angler-hours in 2004 (Figure 20). The total estimated catch of snook from the recreational fishery in Florida Bay increased from a low of 6,538 fish in 1986 to another all-time high of 35,521 fish in 2004 (Figure 20). This increase was due to the concurrent increase in effort by anglers. The 2004 estimated total catch represents a 105.7% increase from the number of fish caught in 2000, however this estimate decreased to 24,156 fish in 2005. In 2004, the estimated total effort placed on the snook stock increased from the 2003 estimate, but the total estimated catch also increased significantly. The 2004 increase in estimated total catch is a good indication that snook abundance is rising, since more snook were caught per unit effort (see Figure 20 where the 2005 correlation is slightly above the regression line). The estimated effort decreased from 2004 to 2005, and the estimated total catch from 2004 to 2005 also decreased. These decreases could be attributed to the park being closed for over three months in 2005. It should be noted again that the estimated total catch of snook decreased dramatically in 1998 and 1999 after five years of good catches and a fairly high annual fishing effort in 1997. As a result, during 1998, state regulations were revised to prevent further overfishing by increasing the minimum size of harvested snook from 24" to 26" and prohibiting the possession of snook over 34", while maintaining a two fish daily bag limit. With current snook regulations allowing only 1 fish per person per day to be harvested in ENP (initiated on January 1, 2002), harvest rates certainly could be affected by the new regulations; however catch rates of snook should not be affected. With the estimated total catch of snook being at an all-time high in 2004, the new snook regulations are continuing to bolster impressive estimated total catch rates in Florida Bay (Figure 9) and for the entire park (Figure 9a). In addition, the annual total estimated catch of snook for the recreational (sport) fishery was highly correlated with the total estimated effort placed on the stock between 1985 and 2005 ($r=0.927$, $N=21$, $p<0.0001$) (Figure 20). Estimated total catch appeared to increase linearly over the entire range of annual effort, suggesting that current catch and effort do not greatly impact the Florida Bay snook stock and that additional increases in total catch and effort may be possible.

Red Drum

The estimated total effort for recreational (sport) fishing for red drum in Florida Bay ranged from a low of 58,093 angler-hours 1988 to an all-time high of 159,144 angler-hours in 2001 (Figure 20), which represents a 173.9% increase in fishing effort. A statistically significant linear relationship ($r=0.642$, $N=21$, $p=0.002$) was found between yearly estimated effort from 1985-2005 and the resultant estimated total catch, suggesting that increases in fishing effort have not greatly impacted the catch of red drum in the recreational (sport) fishery (Figure 20). Estimated effort dropped in 1998, 1999, and 2000, while the estimated catches of red drum concurrently decreased. It should be noted that red drum total catch decreased dramatically in 1999 to 29,678 fish after three years (1996-1998) of very good catches and concurrent high fishing effort. The estimated total catch of red drum increased again from 29,180 fish in 2000 to 43,656 fish in 2001. However, since there was more fishing effort in 2001, the estimated total

catch of red drum was expected to increase. It is a special concern that while the effort placed on the red drum stock in 2002 (157,121 angler-hours) remained relatively high, the estimated total catch decreased significantly (from 43,656 in 2001 to 31,328 fish in 2002) (Figure 20). This is a cause for concern since this indicates that less red drum were caught per unit effort in 2002. If we compare another year similar to that of the 2002 effort (1997 in this case had 154,227 angler-hours), notice that considerably more fish were caught per unit effort in 1997 (45,979 fish) than in 2002 (31,328 fish) (Figure 20). While the estimated effort for red drum decreased from 150,818 angler-hours in 2003 to 146,949 angler-hours in 2004, the estimated catch increased from 29,447 fish to 33,708 fish in the same time period (Figure 20). This is a good indication that more fish were caught while less effort was expended. In 2005, less effort was expended (primarily due to park closures in August-December), and as expected, the estimated total catch of red drum decreased. As noted above, the fishery should be improving when less effort is expended, and more fish are being caught.

Spotted Seatrout

The correlation of yearly estimated total effort with estimated total catch for spotted seatrout was linear and significant ($r=0.616$, $N=21$, $p=0.003$) (Figure 20). Estimated total effort for seatrout ranged from a low of 147,882 angler-hours in 1995 to a high of 249,199 angler-hours in 2001. In conjunction with the increased effort on spotted seatrout from 2000 to 2001, the estimated total catch decreased by about 10,000 fish. This type of trend indicates that yearly fishing effort may have impacted the spotted seatrout fishery. Indeed, the amount of effort in 2002 remained relatively the same as in 2001, however the total estimated catch decreased substantially from 2001 (162,801 fish) to 2002 (136,278 fish) (Figure20). The 2004 effort estimations were similar to those in 2000 (approximately 221,000 angler-hours), however the estimated catch in 2004 (119,776 fish) was much lower than the estimated 172,966 fish caught in 2000 (Figure 20). While the 2004 estimated catch was considerably lower than 2000 estimated catch, the 2004 correlation of catch and effort was close enough to the regression line to continue a significant correlation for the period of record (Figure 20). In 2005, the estimated total catch and the estimated total catch decreased from last year, and the intersection of these two parameters falls below the regression line, suggesting the total catch of seatrout should be higher at the amount of angler-hours that were expended (Figure 20). While these figures represent a few years of data, current catches do not greatly impact the Florida Bay spotted seatrout fishery, and additional increases in total catch may be possible. We will continue to monitor these trends in future annual reports.

Gray Snapper

Annual estimated total effort for the recreational (sport) gray snapper fishery ranged from a low of 96,311 angler-hours in 1985 to a high of 200,889 angler-hours in 2003 (Figure 20). The yearly estimated total catch of gray snapper was the lowest in 1987 (58,401 fish) and the highest in 1989 (123,707 fish) (Figure 20). While effort only slightly increased from 138,807 angler-hours in 1998 to 140,705 angler-hours in 1999, the catch increased quite dramatically during the same time span from 77,267 fish in 1998 to 96,641 fish in 1999. Initially, this

indicates a good recruitment class in 1999, but the low estimated catch in 2000 suggests the contrary. The low estimated catch of gray snapper in 2000 is partially due to the lowest estimated effort (109,571 angler-hours) for gray snapper since 1987. From 2001 to 2003, the estimated catch and the annual estimated effort for gray snapper both increased. In 2004, the estimated total effort decreased while the estimated total catch increased slightly, suggesting that less effort was needed to catch more fish. In addition, the estimated total catch in 2004 (101,233 fish) was the highest it has been since 1990. In 2005, estimated total effort and estimated total catch were the lowest they have been since the 2000 lows. The annual estimated total catch of gray snapper was linearly correlated with the estimated total effort placed on the fishery between 1985 and 2005 ($r=0.608$, $N=21$, $p=0.003$), suggesting that the maximum potential catch of gray snapper in Florida Bay has not been reached, and additional increases in total catch may be possible (Figure 20).

FUTURE WORK/MEETING RESULTS

While the current gamefish monitoring project is evaluating various aspects of catch/harvest rates, total estimated catch/harvest, and fishing/boating activity, additional areas of work are underway or are needed. First, we will be updating in-house and FMRI/NOAA stock assessments on major gamefish species including snook, red drum, black drum, goliath grouper, sheepshead, and sharks. Secondly, we need to incorporate the fisheries database into the park's ORACLE and GIS system for spatially oriented ecological applications. Thirdly, we plan on developing a new fishery data management handbook. Lastly, to update the estimated number of boats on the water in ENP, which contribute to the estimated total effort and estimated total catch and harvest statistics, pilot boat count aerial surveys will be conducted throughout the Ten Thousand Islands and Florida Bay in 2006. In addition, a pilot marine fisheries survey (or monitoring) program at Dry Tortugas National Park (DRTO), which began in 2000, continues to be monitored by fisheries personnel, and the focus will be on developing a survey to complement the implementation of the no-take marine reserve (Research Natural Area) within the boundaries of DRTO. The latest comparison of historical (1981-84) and on-going (2000-2005) DRTO creel data exists (Ault and Smith, 2006).

Several collaborative, on-going studies are underway with Federal/State fishery resource agencies. In a collaborative effort with the NMFS, Southeast Fisheries Center (SEFC), Miami, FL, the recreational (sport) database in ACCESS was provided to fisheries personnel to analyze and synthesize with existing fisheries and environmental databases in order to develop statistical models relating species abundance to environmental conditions and different water management scenarios. The scenarios will incorporate the abundance of goliath grouper and are proposed for smalltooth sawfish and sharks.

In 2006, to better evaluate the effects of CERP-related water flow/releases into the coastal embayments/estuaries, specific areas and fishing areas which receive the most impacts from freshwater inflow, for example Area 1 and Area 4, annual CPUE's of selected sportfish will be

analyzed/correlated with environmental conditions within individual fishing areas.

The FFWCC field intercept surveys are continuing to provide information for guided and recreational (sport) anglers to estimate angler total catch using existing NMFS estimates. Guide parties fishing in ENP waters during weekdays have also been interviewed by FFWCC personnel at Chokoloskee to obtain information on angler catch reports and to obtain fish measurements. We are diligently attempting to keep from duplicating records that we obtain from permitted guides (that fish in the Chokoloskee area) and reports that are taken by FFWCC personnel.

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Table 1. Mean catch/harvest rates (fish per angler-hour) of recreational (sport) anglers in Everglades National Park, 2005.

Recreational (Sport) Anglers in Florida Bay (Areas 1-5)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.3095± 0.0345	0.0971 ± 0.0075	644	125
Red Drum	0.2829 ± 0.0321	0.1095 ± 0.0093	607	274
Spotted Seatrout	0.7538 ± 0.0665	0.2658 ± 0.0216	1,037	568
Gray Snapper	0.7142 ± 0.0657	0.2914 ± 0.0387	695	267
Tarpon	0.1473 ± 0.0541	N/A	108	0
Black Drum	0.2343 ± 0.0419	0.1713 ± 0.0351	132	74
Sheepshead	0.2190 ± 0.0439	0.1070 ± 0.0177	107	45
Spanish Mackerel	0.3245 ± 0.1275	0.2235 ± 0.0939	103	64
Grouper	0.1656 ± 0.0226	0.0905 ± 0.0233	326	15
Ladyfish	0.4507 ± 0.0511	0.1623 ± 0.0675	787	24
Crevalle Jack	0.4072 ± 0.0446	0.1324 ± 0.0359	854	24
Recreational (Sport) Anglers in Everglades City (Area 6)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.4811 ± 0.0484	0.1119 ± 0.0194	810	129
Red Drum	0.2093 ± 0.0279	0.1221 ± 0.0148	460	252
Spotted Seatrout	0.5596 ± 0.0909	0.2552 ± 0.0265	550	304
Gray Snapper	0.5724 ± 0.1127	0.1537 ± 0.0246	370	84
Tarpon	0.2237 ± 0.1345	N/A	61	0
Black Drum	0.1518 ± 0.0479	0.1091 ± 0.0303	40	20
Sheepshead	0.2664 ± 0.0868	0.2024 ± 0.0974	77	31
Spanish Mackerel	0.2411 ± 0.1061	0.1542 ± 0.0437	74	40
Grouper	0.2297 ± 0.0440	0.1197 ± 0.0719	232	13
Ladyfish	0.5004 ± 0.0690	0.2878 ± 0.1193	572	37
Crevalle Jack	0.3018 ± 0.0530	0.1754 ± 0.0886	532	10

Table 1 (cont.)

Recreational (Sport) Anglers in ENP (Areas 1-6)				
Species	**CPUE** ±**95% Conf. Interval**	**HPUE** ±**95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.4051 ± 0.0313	0.1046 ± 0.0131	1,454	254
Red Drum	0.2512 ± 0.0219	0.1155 ± 0.0086	1,067	526
Spotted Seatrout	0.6865 ± 0.0539	0.2621 ± 0.0168	1,587	872
Gray Snapper	0.6649 ± 0.0582	0.2585 ± 0.0306	1,065	351
Tarpon	0.1749 ± 0.0596	N/A	169	0
Black Drum	0.2151 ± 0.0343	0.1581 ± 0.0288	172	94
Sheepshead	0.2388 ± 0.0444	0.1459 ± 0.0421	184	76
Spanish Mackerel	0.2896 ± 0.0865	0.1969 ± 0.0603	177	104
Grouper	0.1923 ± 0.0227	0.1041 ± 0.0353	558	28
Ladyfish	0.4716 ± 0.0414	0.2385 ± 0.0781	1,359	61
Crevalle Jack	0.3667 ± 0.0343	0.1451 ± 0.0362	1,386	34

* Number of fishing parties.

Table 2. Mean catch/harvest rates (fish per angler-hour) of professionally guided anglers in Everglades National Park, 2005.

Guided Anglers in Florida Bay (Areas 1-5)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.3809 ± 0.0398	0.1137 ± 0.0143	563	83
Red Drum	0.4786 ± 0.0573	0.1288 ± 0.0108	676	149
Spotted Seatrout	1.4547 ± 0.0963	0.3627 ± 0.0280	918	256
Gray Snapper	1.5651 ± 0.1472	0.6923 ± 0.0563	362	236
Tarpon	0.1837 ± 0.0173	N/A	367	1
Bonefish	0.2460 ± 0.0557	N/A	89	0
Guided Anglers in Everglades City (Area 6)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.7830 ± 0.0650	0.1099 ± 0.0115	822	114
Red Drum	0.4432 ± 0.0378	0.1466 ± 0.0083	729	429
Spotted Seatrout	1.2797 ± 0.1030	0.5168 ± 0.0308	635	448
Gray Snapper	0.9941 ± 0.1245	0.3660 ± 0.0661	226	138
Tarpon	0.2784 ± 0.0479	N/A	141	0
Bonefish	N/A	N/A	0	0

Guided Anglers in ENP (Areas 1-6)				
Species	**CPUE ±95% Conf. Interval**	**HPUE ±95% Conf. Interval**	**Sample Size *** CPUE/HPUE	
Snook	0.6196 ± 0.0431	0.1114 ± 0.0090	1,385	197
Red Drum	0.4602 ± 0.0338	0.1420 ± 0.0068	1,405	578
Spotted Seatrout	1.3831 ± 0.0709	0.4607 ± 0.0227	1,553	704
Gray Snapper	1.3457 ± 0.1048	0.5719 ± 0.0459	588	374
Tarpon	0.2100 ± 0.0186	N/A	508	1
Bonefish	0.2460 ± 0.0557	N/A	89	0

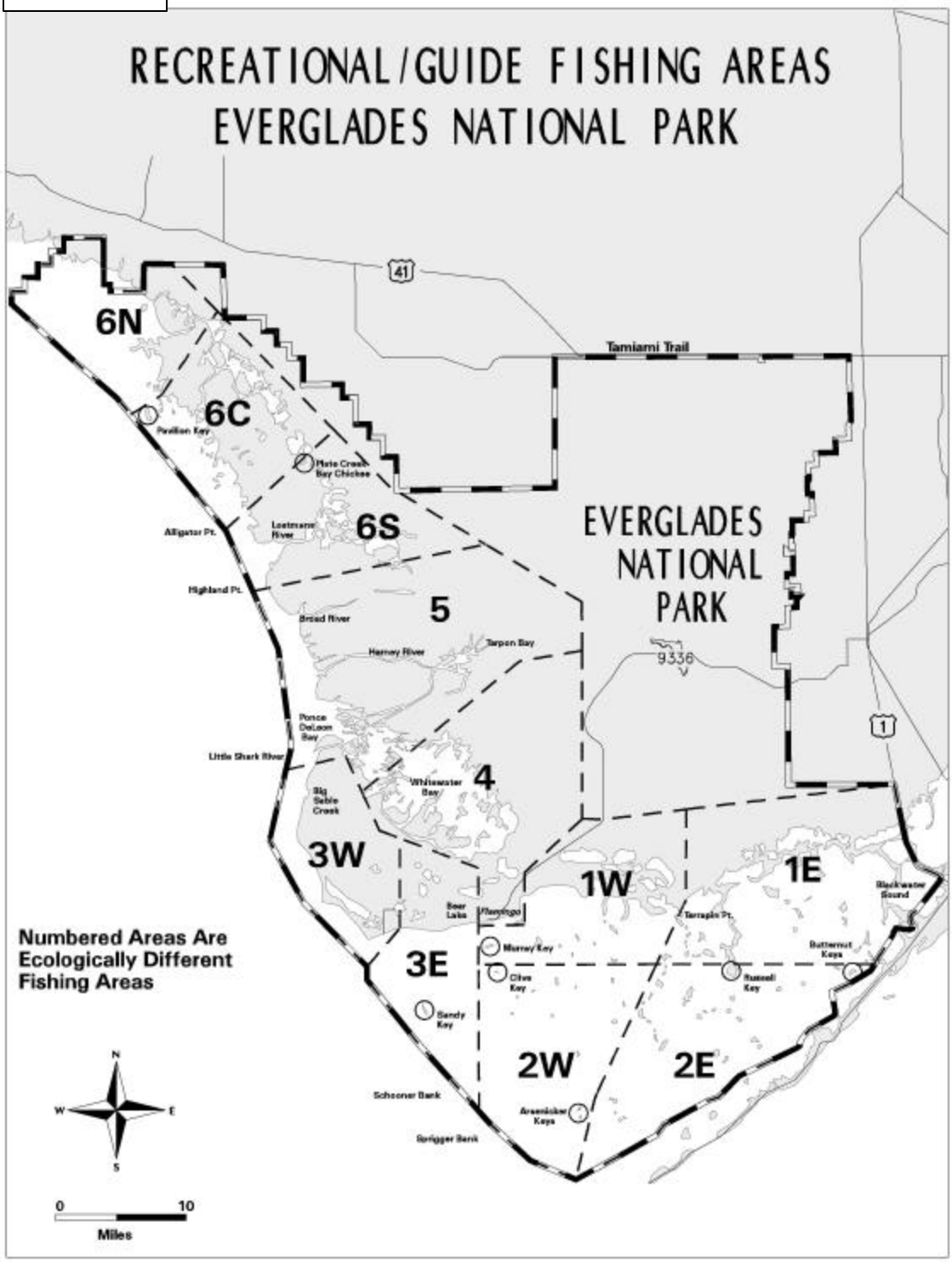
* Number of fishing parties.

Table 3. Total estimated catch and harvest by recreational (sport and professionally guided) anglers in Everglades National Park, 2005.

Recreational (Sport) Anglers						
Species	**Florida Bay (Areas 1-5)**		**Everglades City (Area 6)**		**Florida Bay & Everglades City (Areas 1-6)**	
	Catch	**Harvest**	**Catch**	**Harvest**	**Catch**	**Harvest**
Snook	24,156	1,732	41,526	1,095	65,682	2,827
Red Drum	24,533	4,332	8,908	2,961	33,440	7,293
Spotted Seatrout	112,854	22,192	32,564	9,649	145,418	31,841
Gray Snapper	68,247	10,460	24,276	1,886	92,523	12,346
Tarpon	1,956	0	874	0	2,830	0
Black Drum	5,877	2,319	440	186	6,318	2,505
Sheepshead	4,386	916	2,347	638	6,733	1,554
Spanish Mackerel	6,062	2,989	1,886	840	7,948	3,829
Grouper	8,827	197	4,795	147	13,622	344
Ladyfish	49,762	471	33,071	1,352	82,832	1,823
Crevalle Jack	52,714	538	13,925	160	66,638	698
Other species	77,731	3,820	40,588	5,701	118,319	9,521
Total	437,105	49,966	205,200	24,615	642,303	74,581

Professionally Guided Anglers						
Species	**Florida Bay (Areas 1-5)**		**Everglades City (Area 6)**		**Florida Bay & Everglades City (Areas 1-6)**	
	Catch	**Harvest**	**Catch**	**Harvest**	**Catch**	**Harvest**
Snook	8,317	341	22,747	508	31,064	848
Red Drum	12,660	862	13,404	2,749	26,064	3,609
Spotted Seatrout	52,072	4,204	32,524	10,188	84,597	14,392
Gray Snapper	20,459	5,977	8,682	1,909	29,141	7,886
Tarpon	2,288	3	1,165	0	3,453	3
Bonefish	588	0	0	0	588	0
Other Species	46,791	3,960	25,000	3,494	71,874	7,455
Total	143,175	15,348	103,522	18,846	246,780	34,193

Figure 1.


RECREATIONAL/GUIDE FISHING AREAS
EVERGLADES NATIONAL PARK
41
6N
6C
6S
5
4
3W
3E
2W
2E
1W
1E
Tamiami Trail
EVERGLADES NATIONAL PARK
9336
1
Pavilion Key
Mate Creek Bay Chickee
Alligator Pt.
Lostmans River
Highland Pt.
Broad River
Harney River
Tarpon Bay
Ponce DeLeon Bay
Little Shark River
Whitewater Bay
Big Sable Creek
Bear Lake
Flamingo
Terrapin Pt.
Blackwater Sound
Murray Key
Clive Key
Sandy Key
Buttonwood Keys
Russell Key
Schooner Bank
Arsenicker Keys
Sprigger Bank
Numbered Areas Are Ecologically Different Fishing Areas
N
W
E
S
0
10
Miles

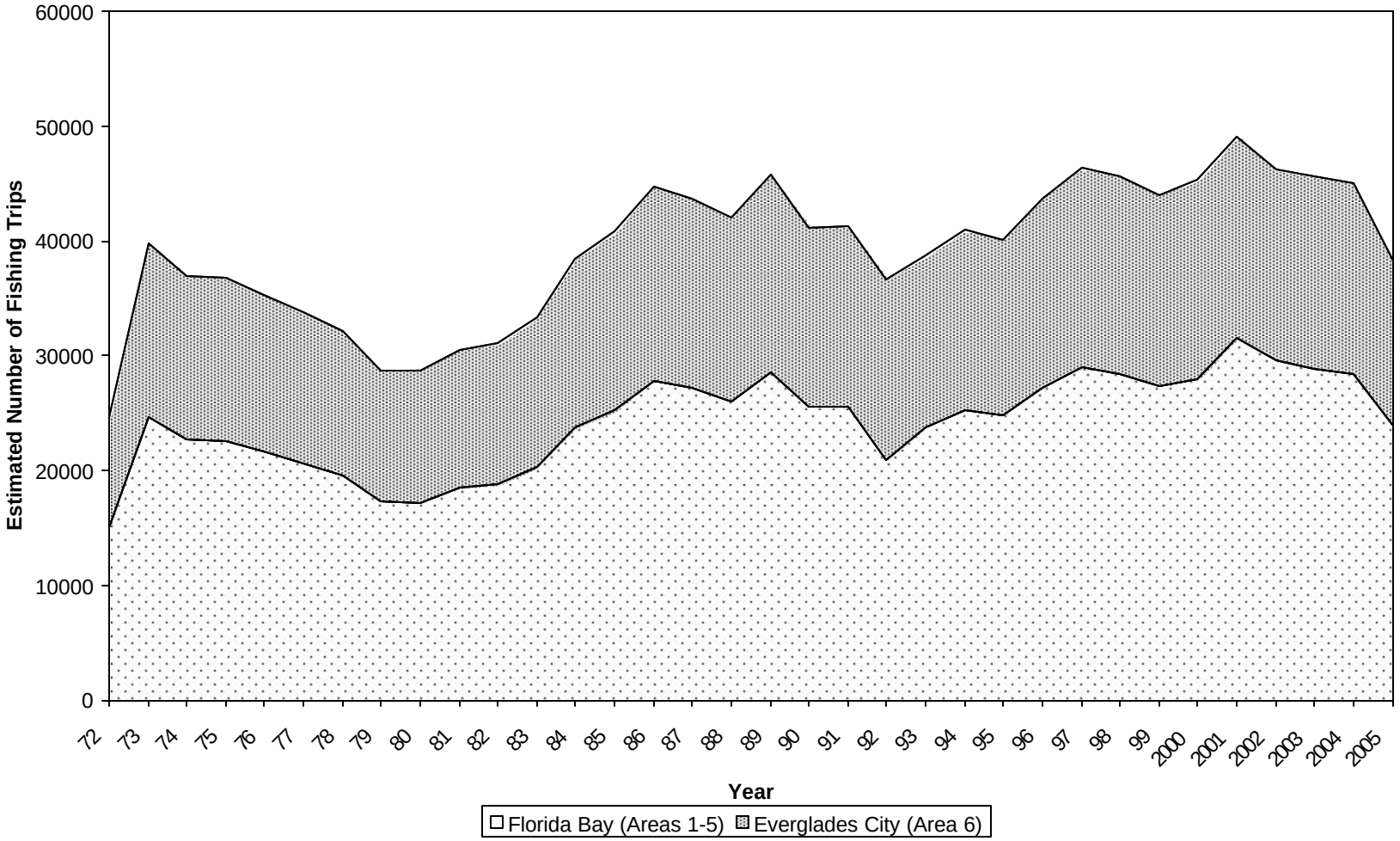


Figure 2. Estimated number of recreational (sport) fishing trips within Everglades National Park, 1972-2005.

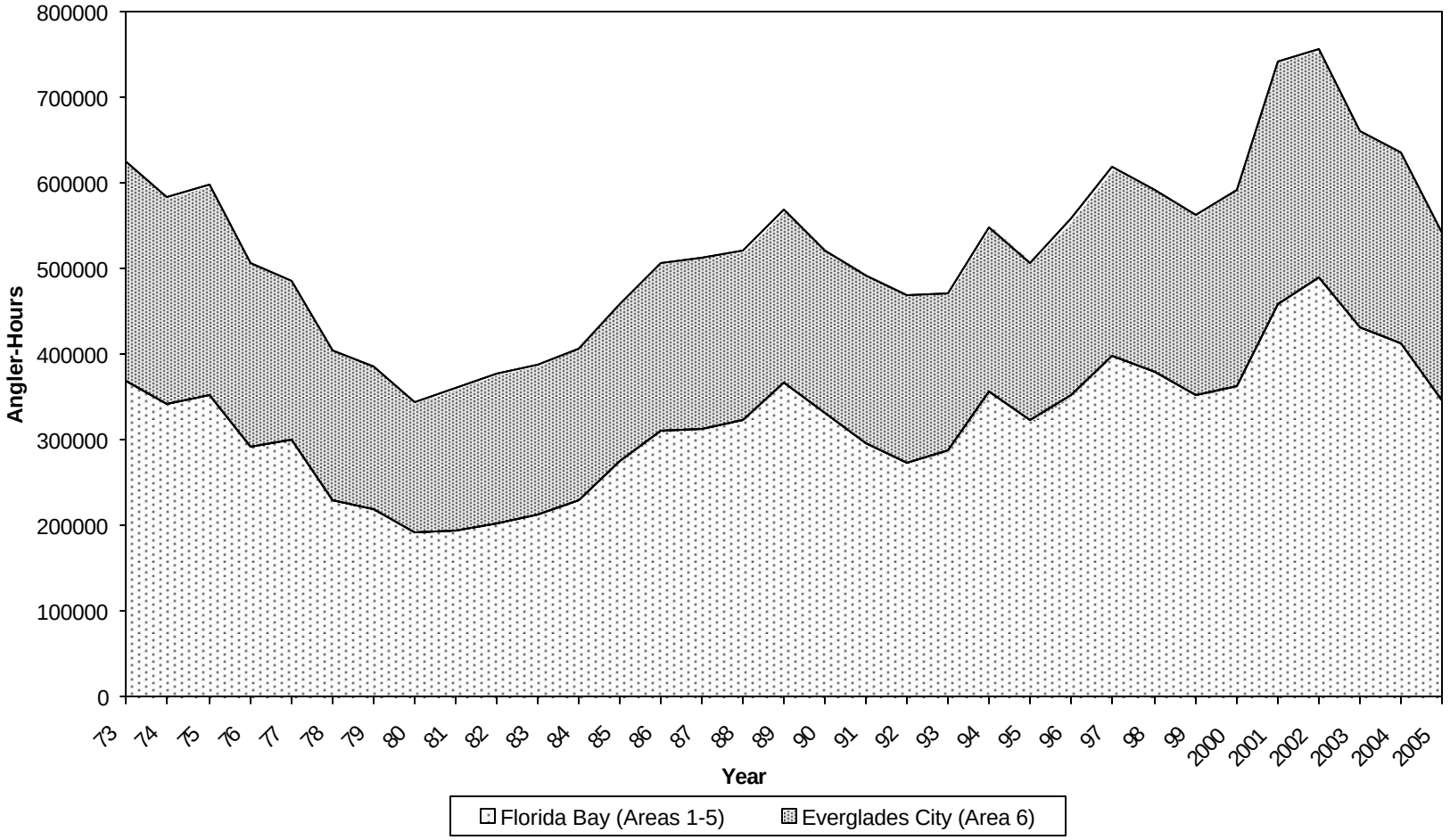


Figure 3. Estimated total effort (angler-hours) of recreational (sport) fishermen within Everglades National Park, 1973-2005.

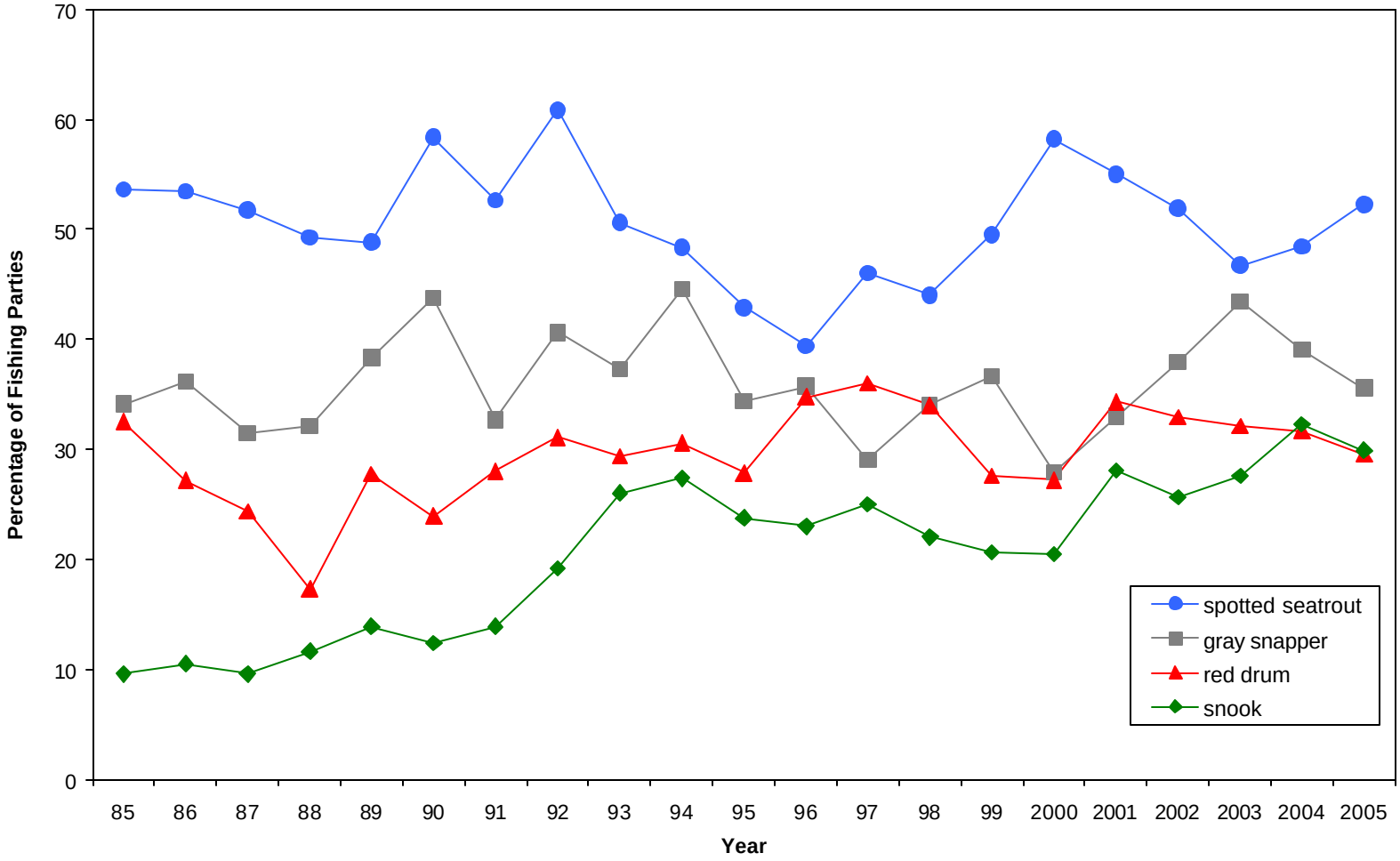


Figure 4. Percentage of recreational (sport) fishing parties interviewed at Flamingo (Areas 1 to 5) catching spotted seatrout, gray snapper, red drum, and snook from 1985-2005.

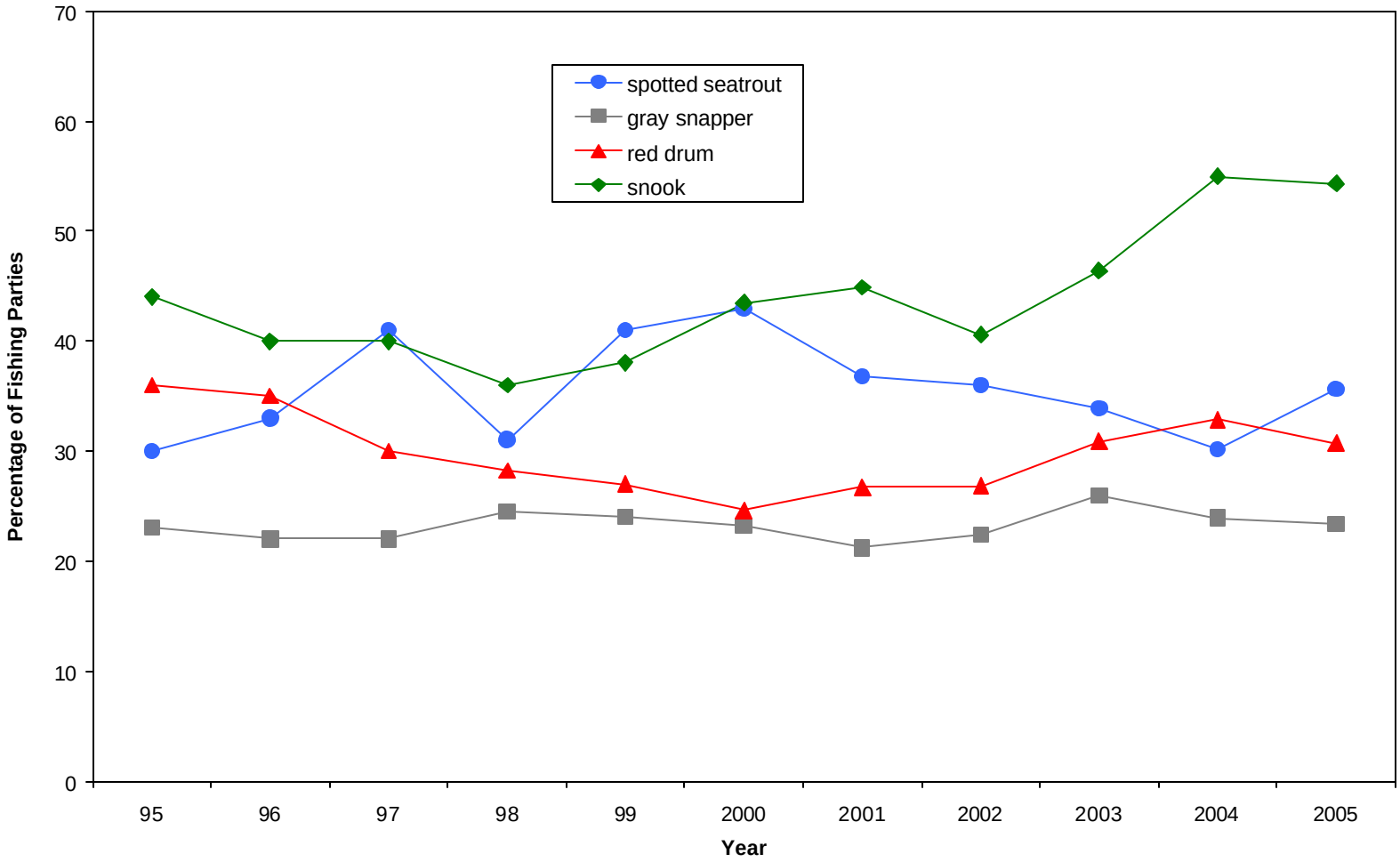


Figure 4a. Percentage of recreational (sport) fishing parties interviewed at Everglades City (Area 6) catching spotted seatrout, gray snapper, red drum, and snook from 1995-2005.

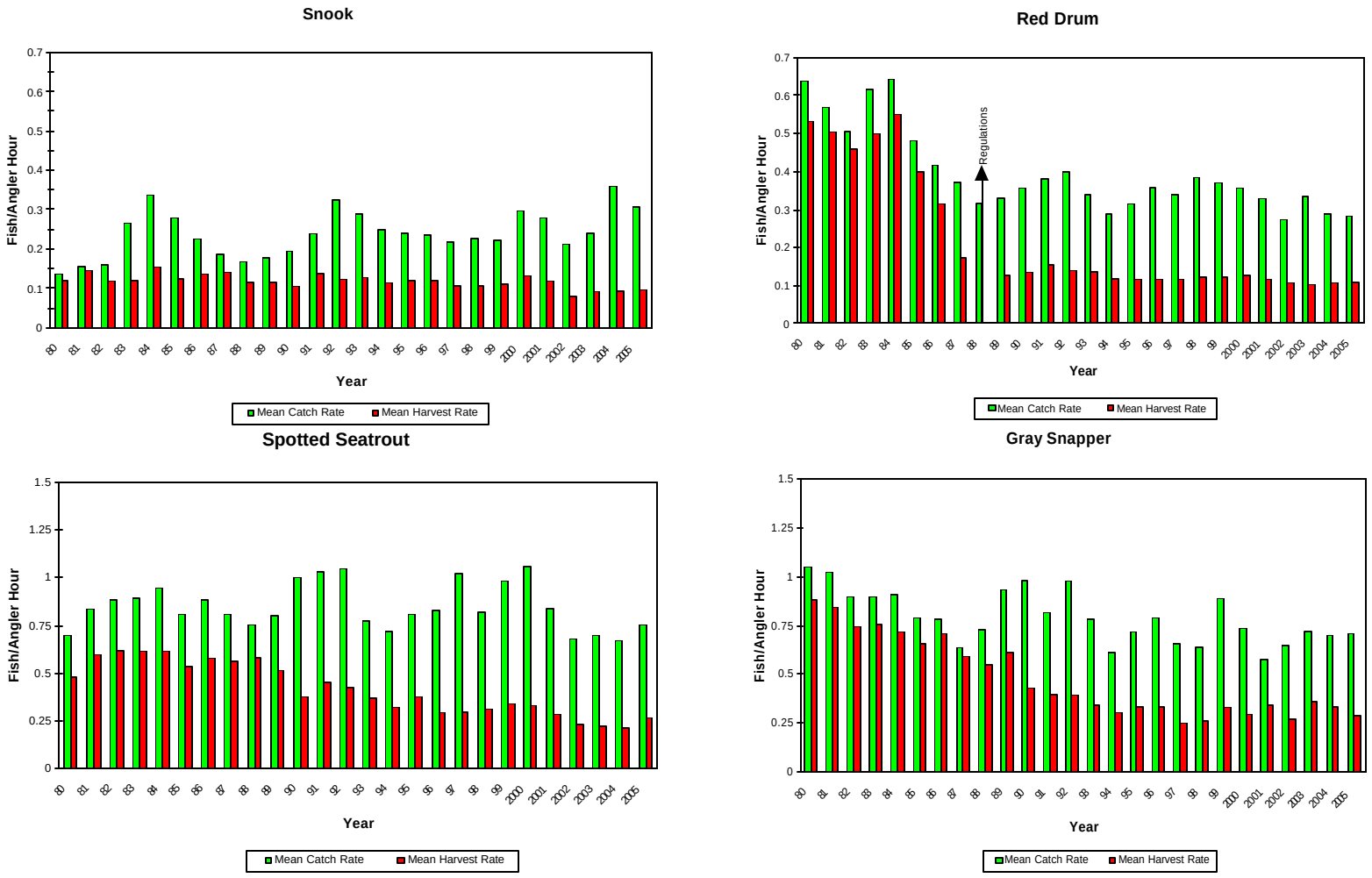


Figure 5. Recreational (sport) catch and harvest rates for the four major species of gamefish in Florida Bay (Areas 1-5), 1980-2005.

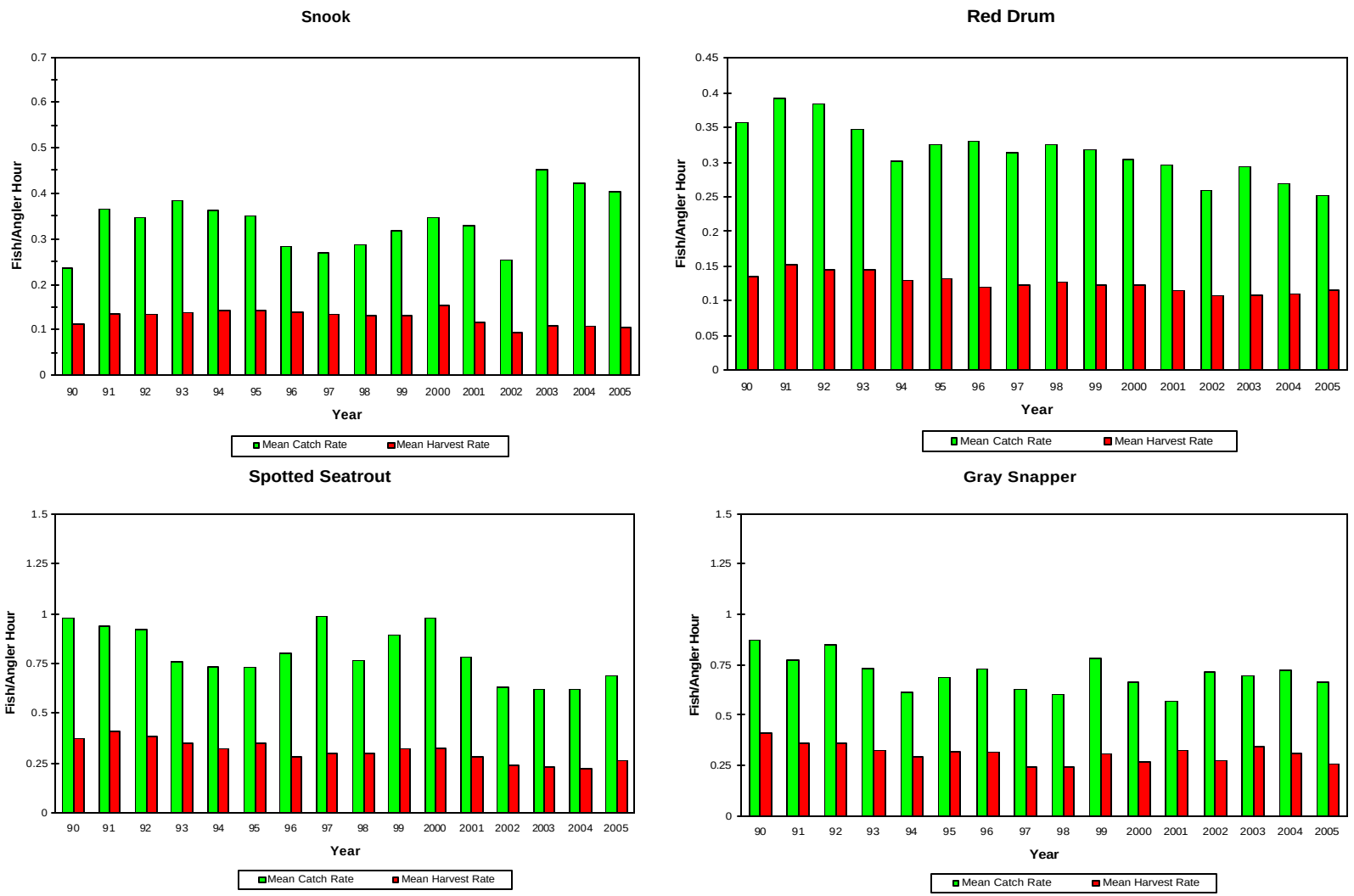


Figure 6. Recreational (sport) catch and harvest rates for the four major species of gamefish in Everglades National Park (Areas 1-6), 1990-2005.

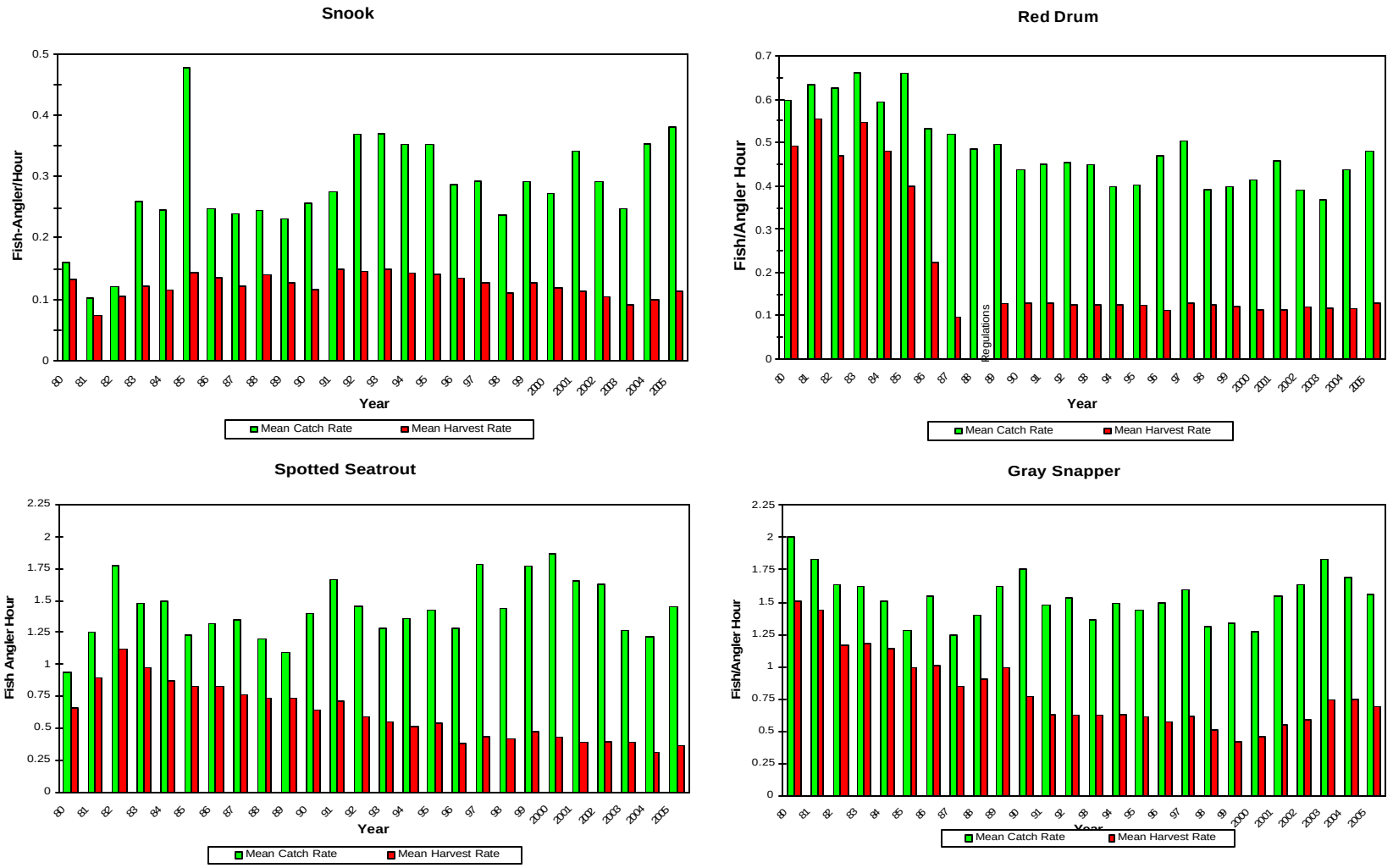
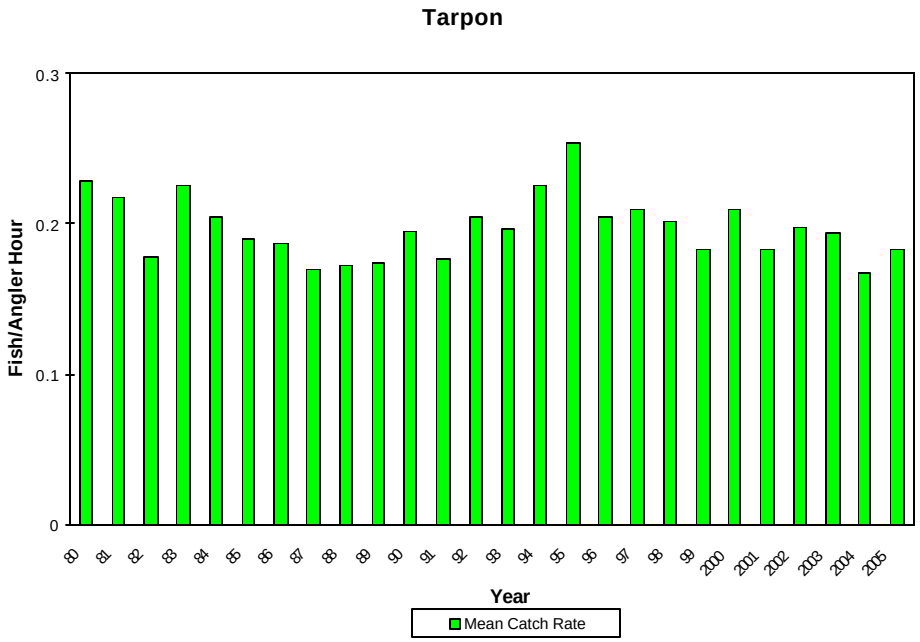


Figure 7. Professional guide catch and harvest rates for four major sportfish species in Florida Bay (Areas 1-5), 1980-2005.



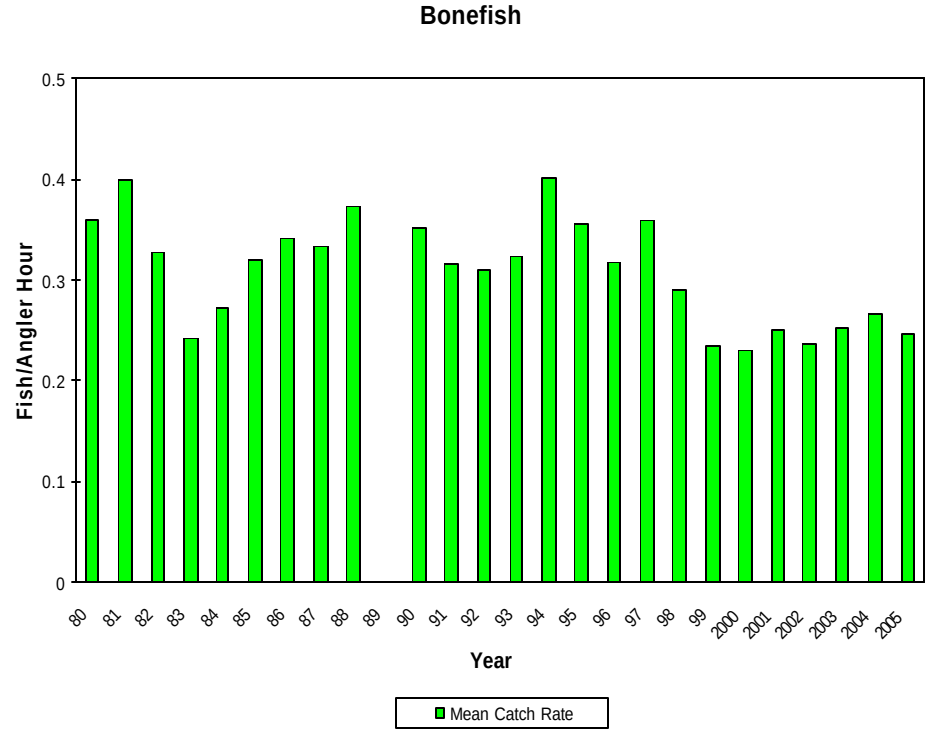


Figure 8. Professional guide catch rates for tarpon and bonefish in Florida Bay (Areas 1-5), 1980-2005.

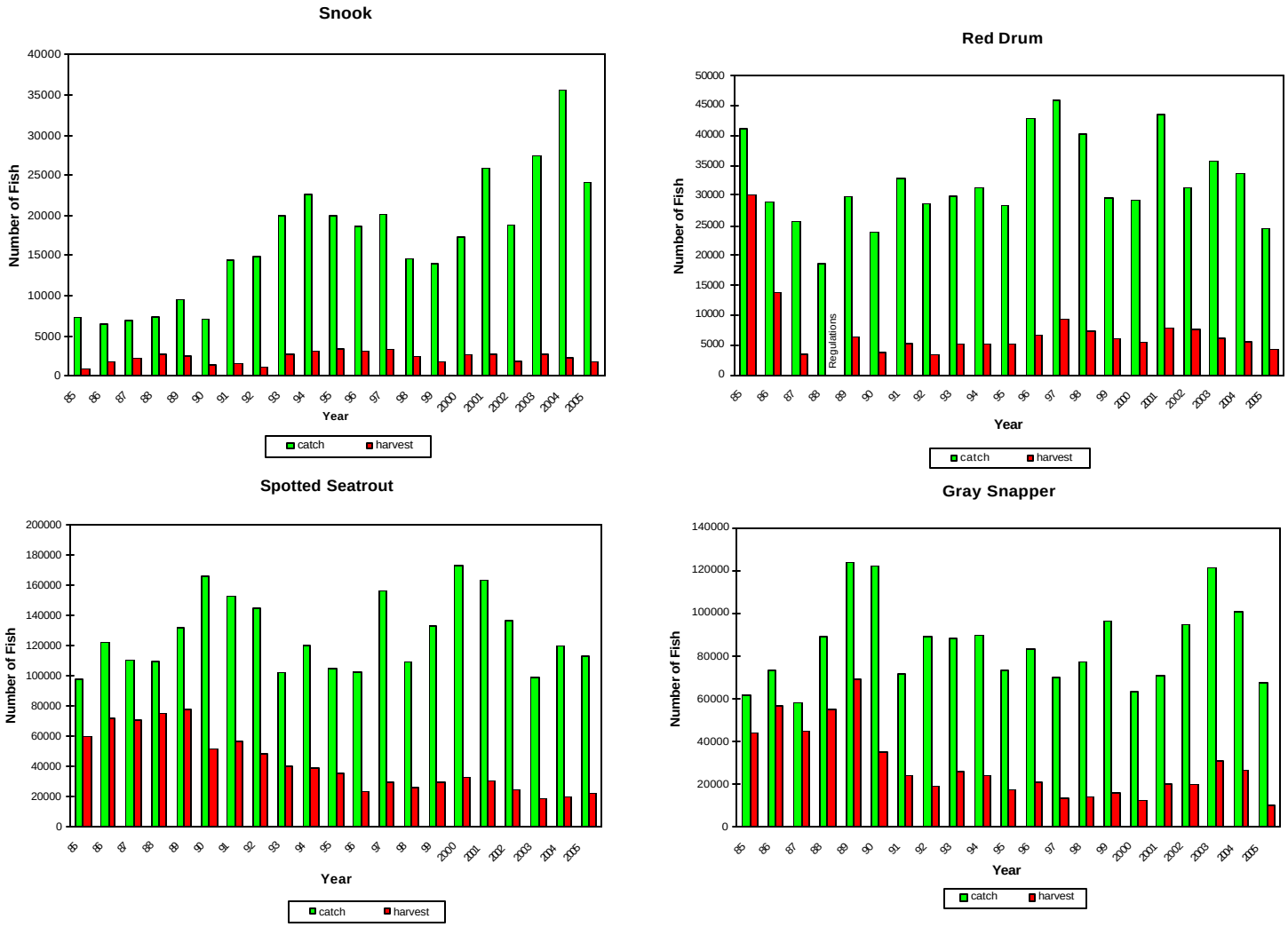


Figure 9. Estimated total catch and harvest for the four major species of gamefish by recreational(sport) anglers in Florida Bay (Areas 1-5), 1985-2005.

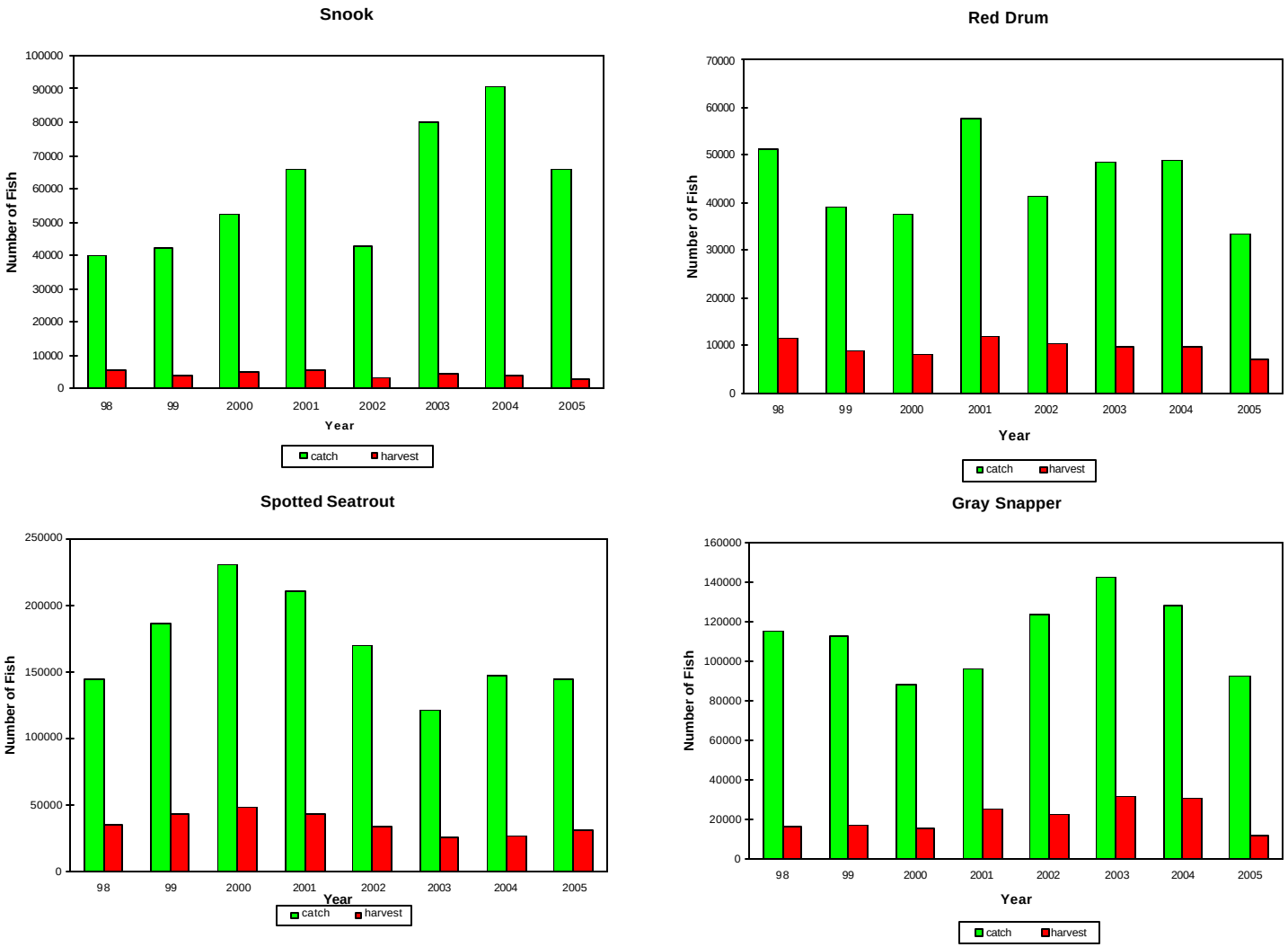


Figure 9a. Estimated total catch and harvest for the four major species of gamefish by recreational(sport) anglers in Florida Bay and Everglades City (Areas 1-6), 1998-2005.

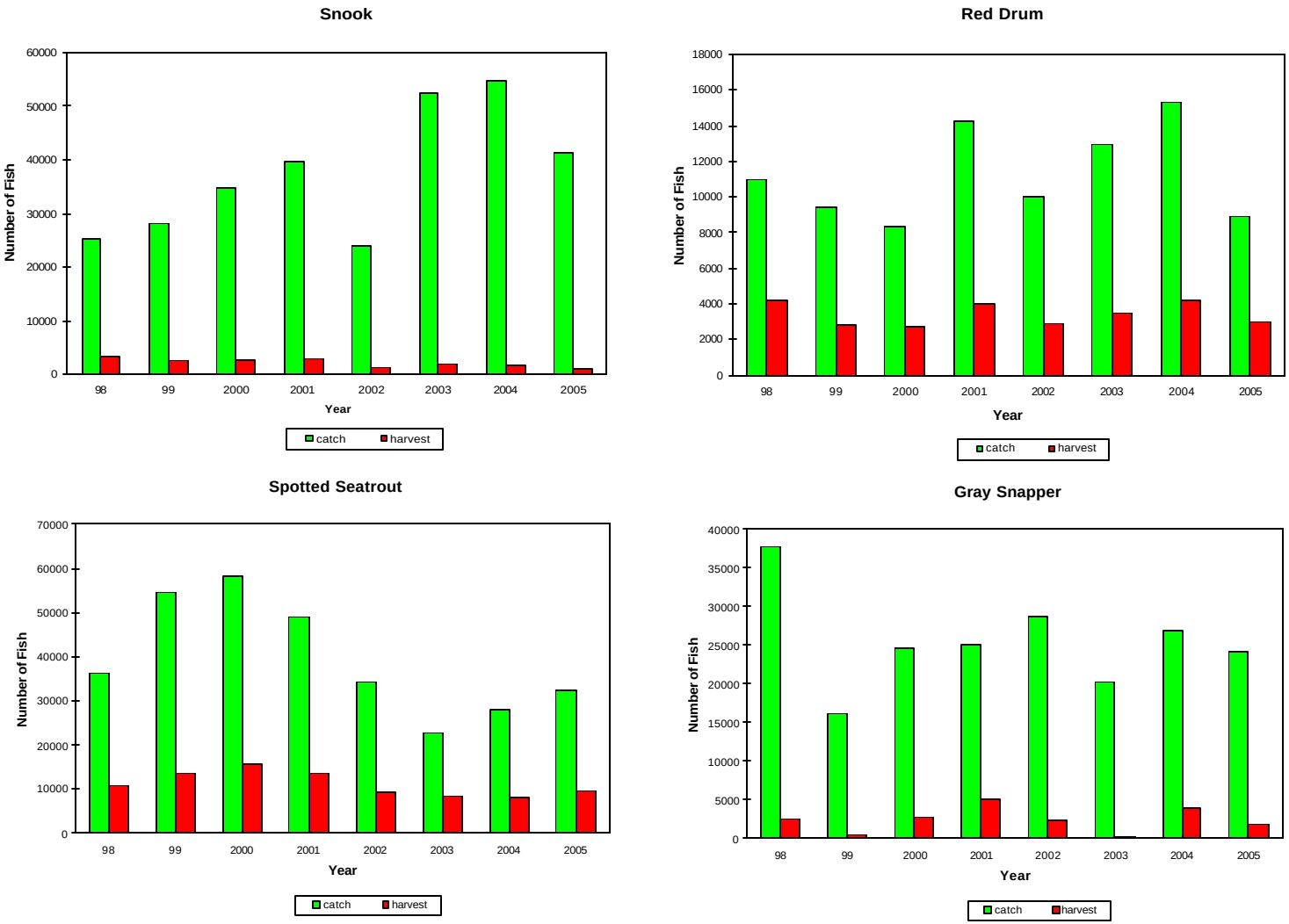


Figure 9b. Estimated total catch and harvest for the four major species of gamefish by recreational(sport) anglers in Everglades City (Area 6), 1998-2005.

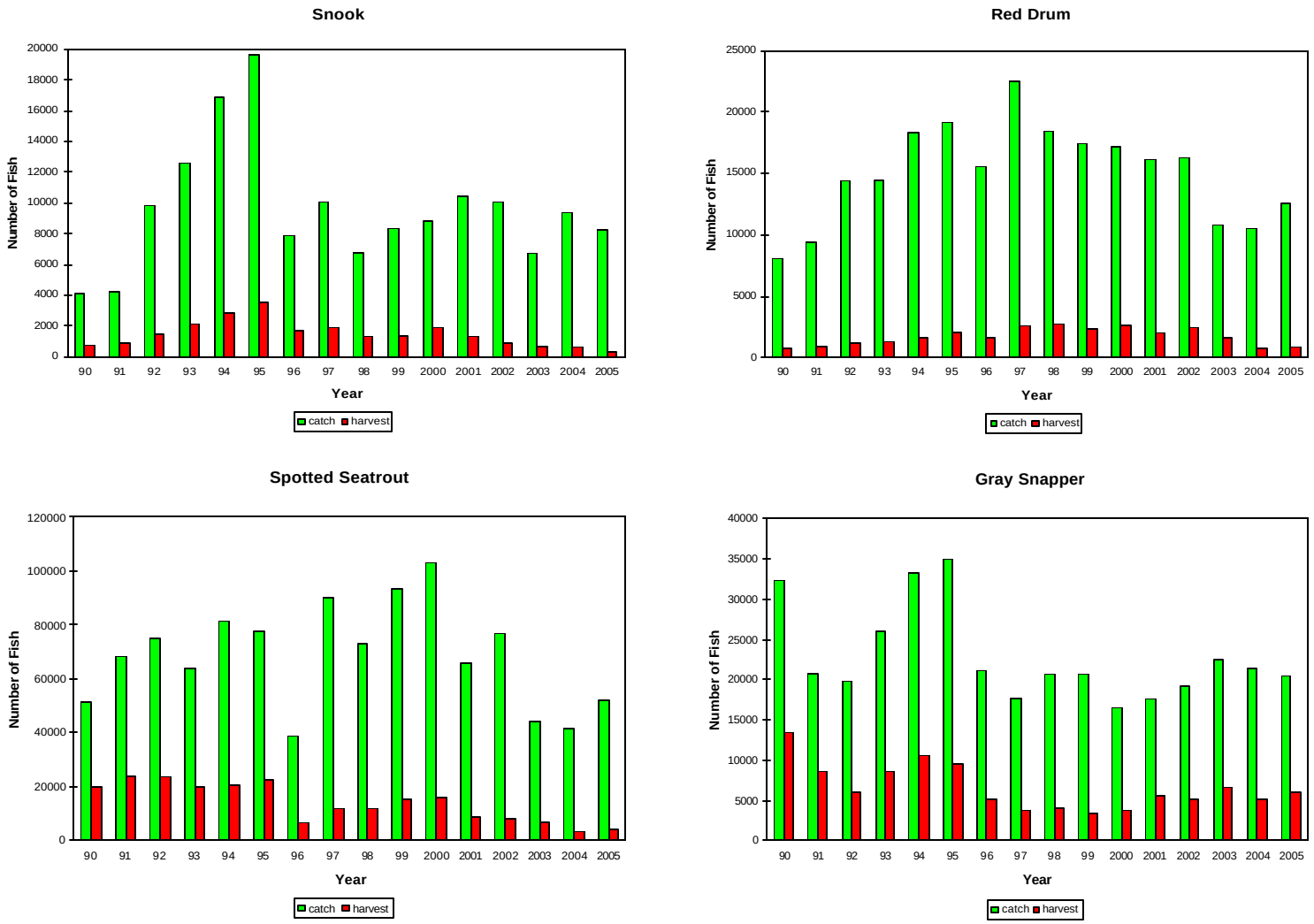
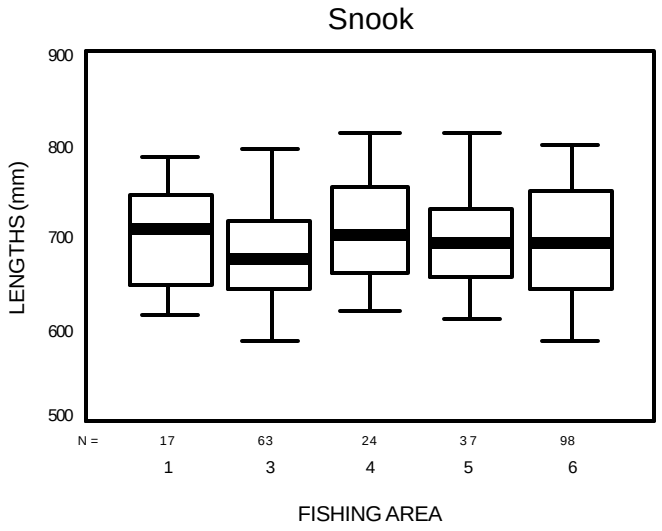
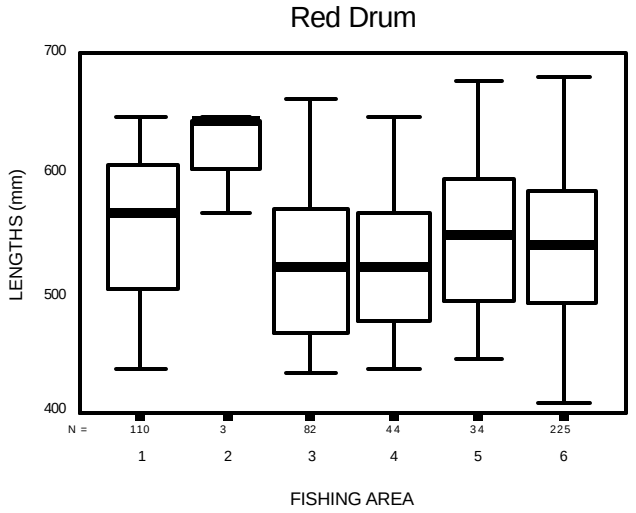
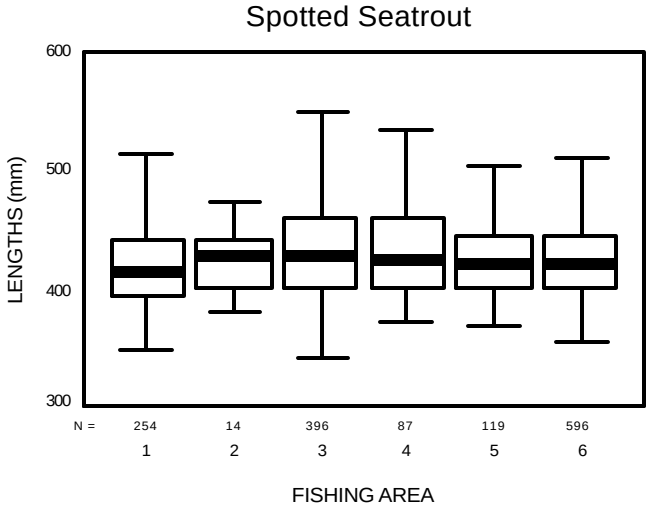


Figure 10. Estimated total catch and harvest of the four major species of gamefish by professionally guided anglers in Florida Bay (Areas 1-5), 1990-2005.







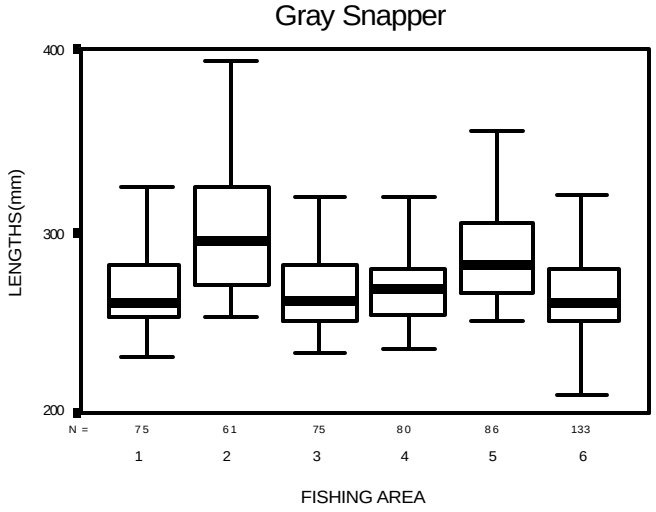


Figure 11. The lengths of the four major species of fish caught by recreational (sport) anglers in the six ecologically distinct fishing areas within Everglades National Park during 2005. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area. Snook, Red Drum, and Gray Snapper were measured by fork length (FL); Spotted Seatrout were measured by total length (TL).

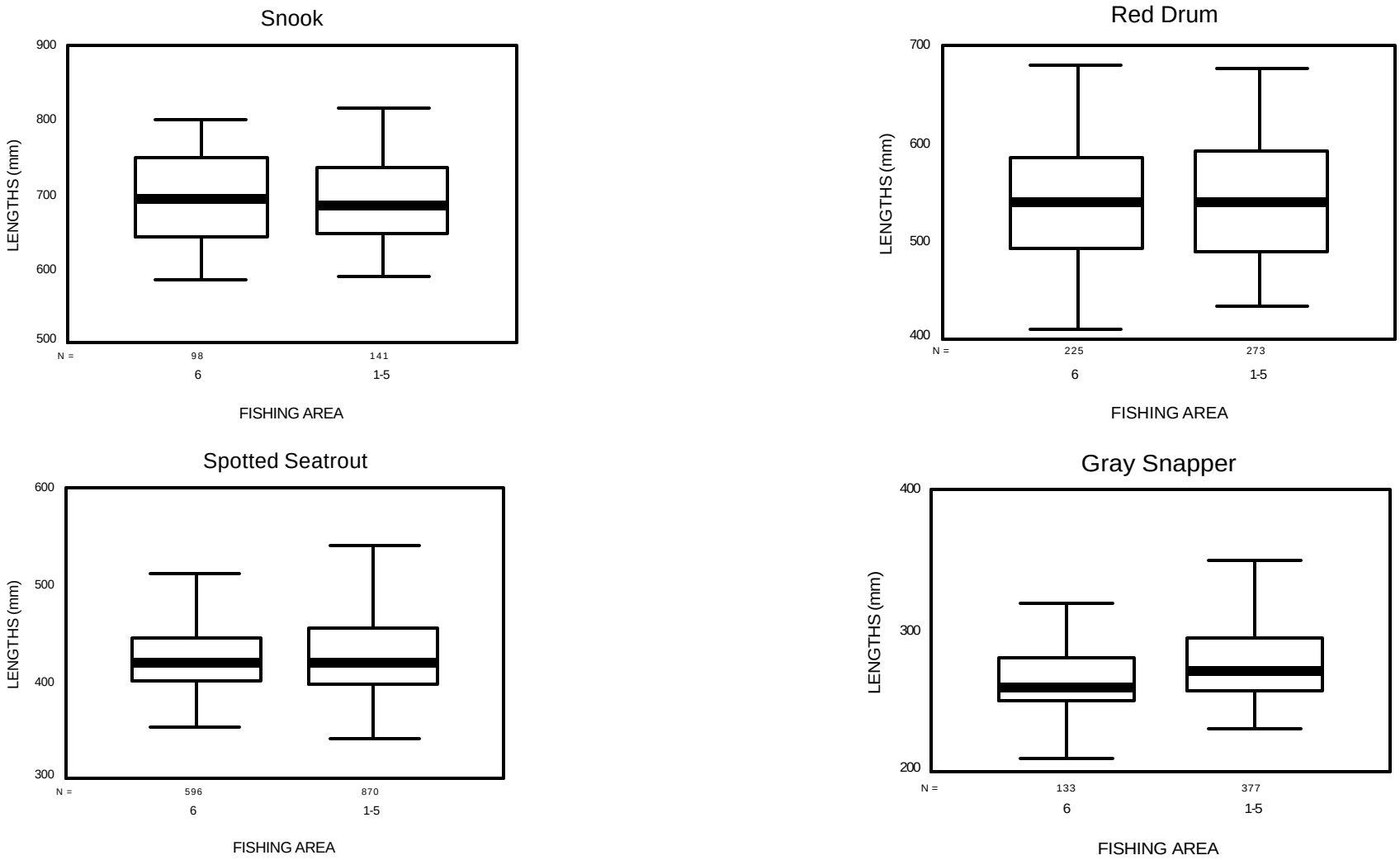


Figure 12. The lengths of the four major species of fish caught by recreational (sport) anglers in Florida Bay (Areas 1-5) and Everglades City (Area 6) within Everglades National Park during 2005. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area. Snook, Red Drum, and Gray Snapper were measured by fork length (FL); Spotted Seatrout were measured by total length (TL).

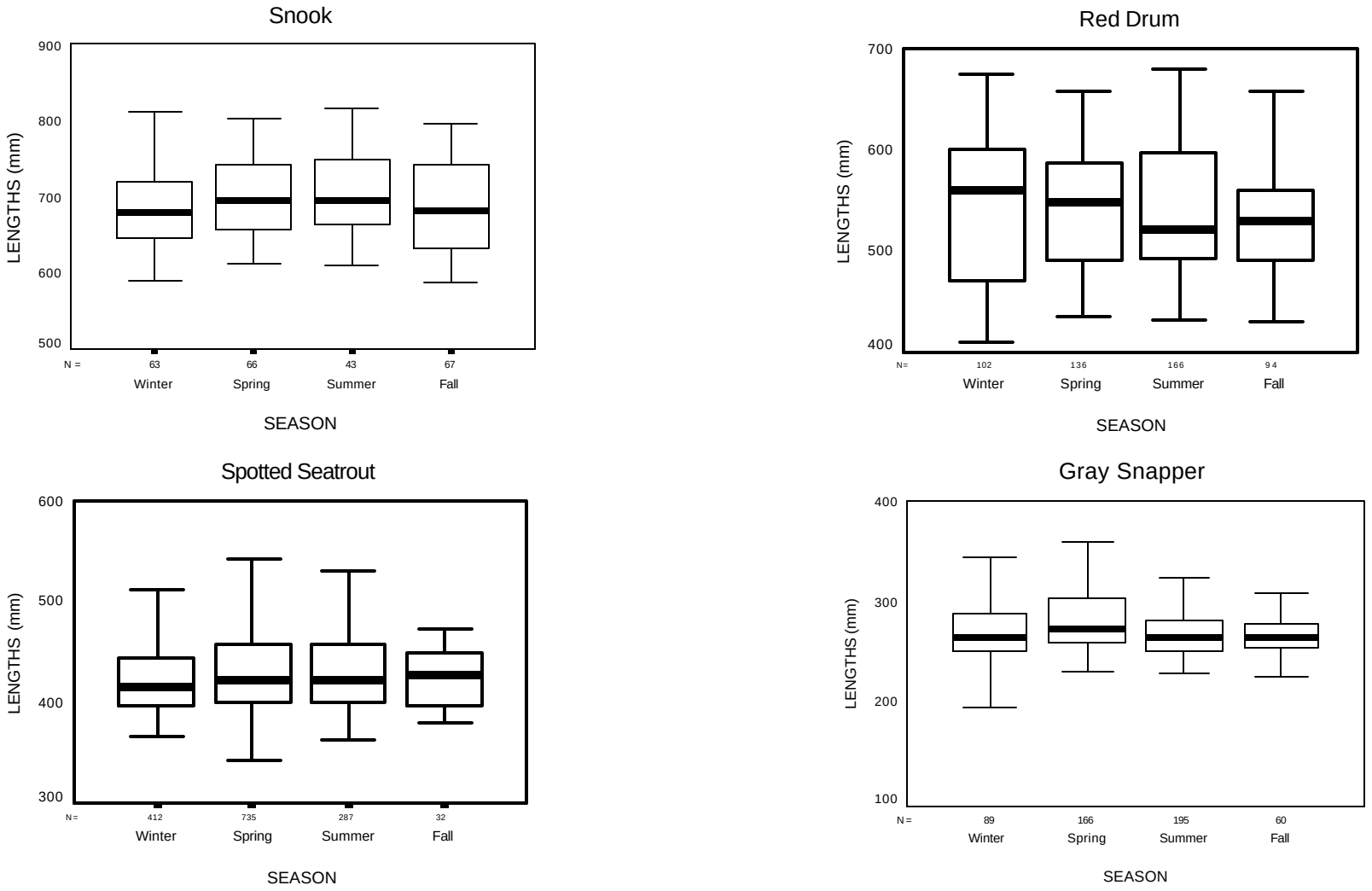
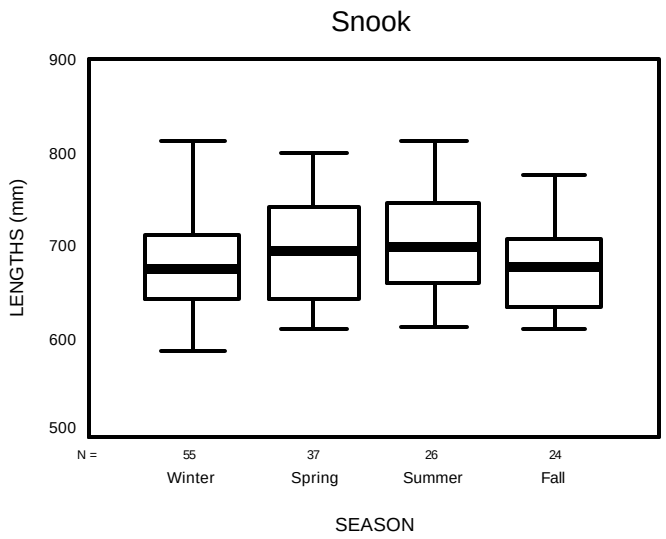
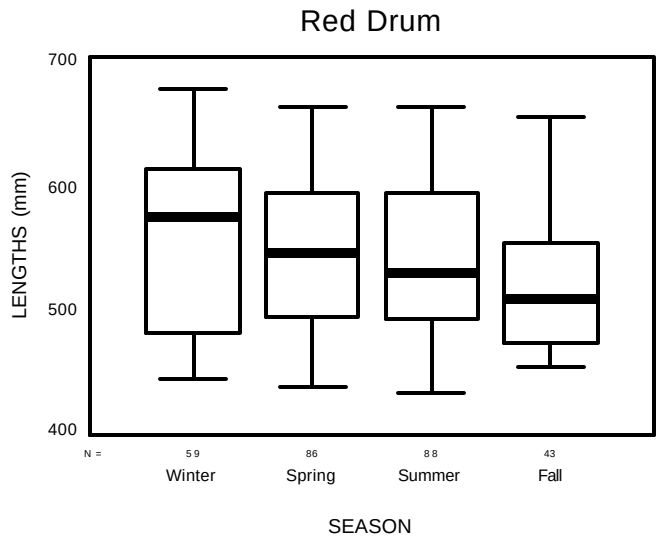
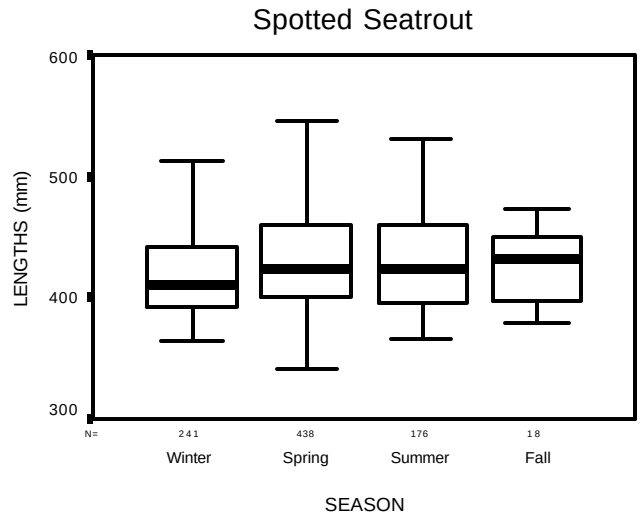


Figure 13. The lengths of the four major species of fish caught by recreational (sport) anglers in Everglades National Park during the fall, spring, summer, and winter of 2005. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area; Winter = January-March, Spring = April-June, Summer = July-September, and Fall = October-December. Snook, Red Drum, and Gray Snapper were measured by fork length (FL); Spotted Seatrout were measured by total length (TL).







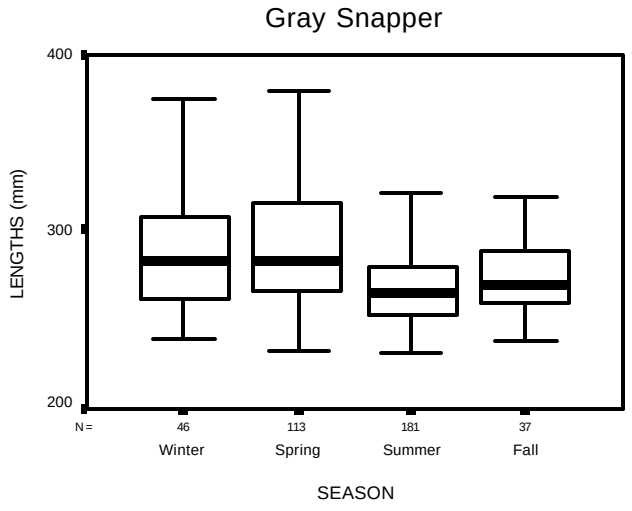


Figure 14. The lengths of the four major species of fish caught by recreational (sport) anglers in Florida Bay (Areas 1-5) during the fall, spring, summer, and winter of 2005. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area; Winter = January-March, Spring = April-June, Summer = July-September, and Fall = October-December. Snook, Red Drum, and Gray Snapper were measured by fork length (FL); Spotted Seatrout were measured by total length (TL).

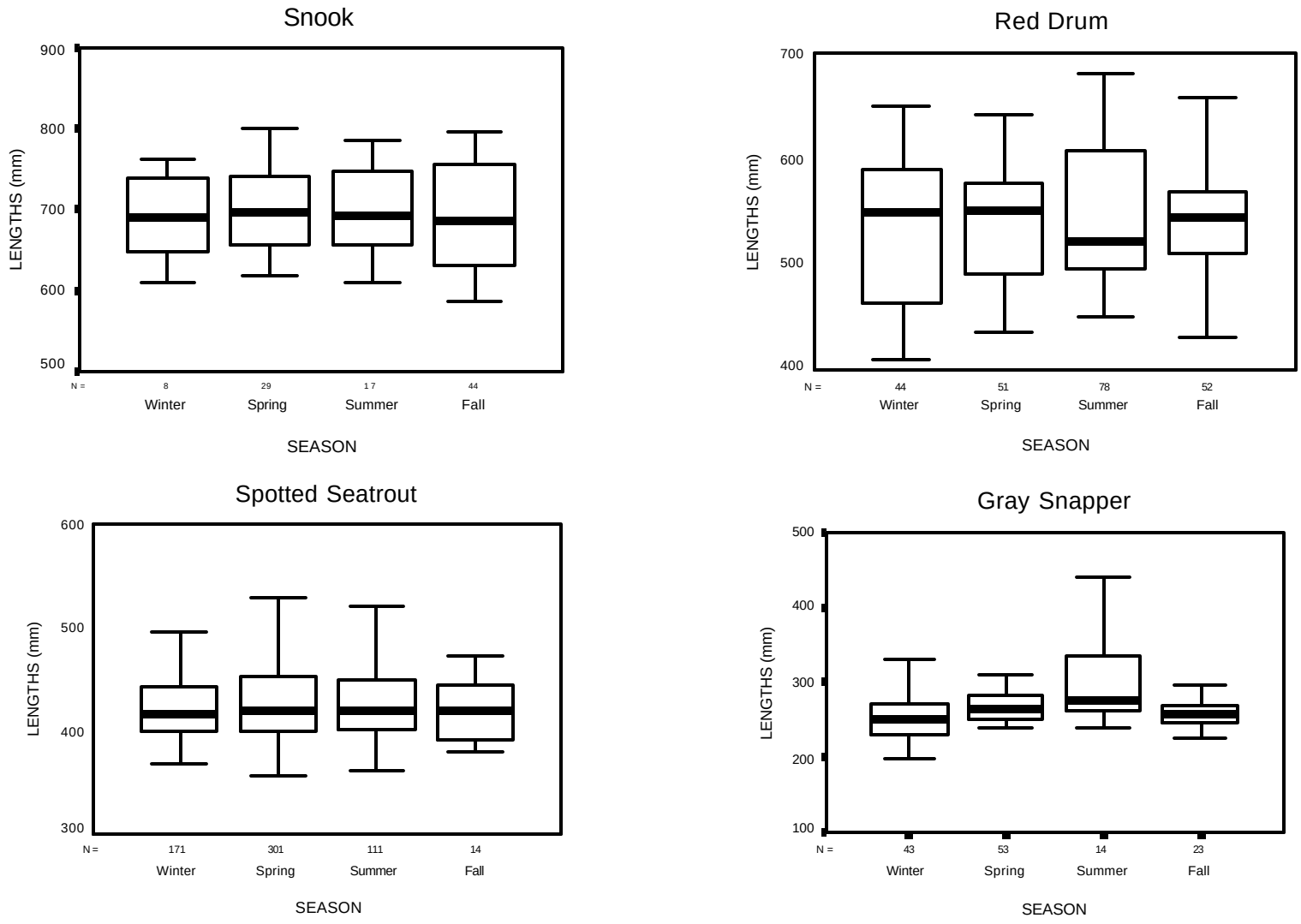


Figure 15. The lengths of the four major species of fish caught by recreational (sport) anglers in Everglades City (Area 6) during the fall, spring, summer, and winter of 2005. The "box" represents the interquartile range; the horizontal line in the "box" represents the median; N represents the number of fish measured in each area; Winter = January-March, Spring = April-June, Summer = July-September, and Fall = October-December. Snook, Red Drum, and Gray Snapper were measured by fork length (FL); Spotted Seatrout were measured by total length (TL).

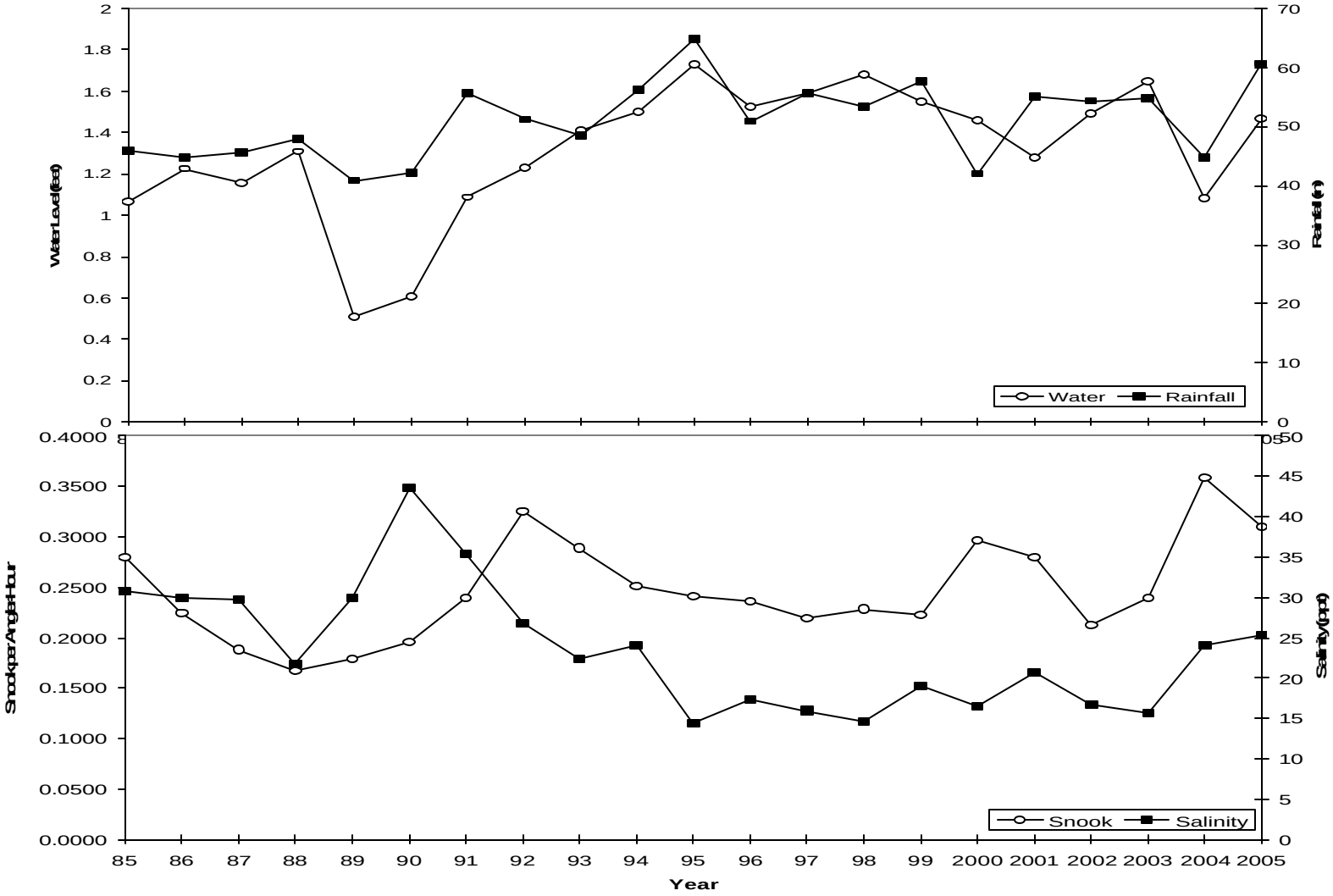


Figure 16. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and sport angler catch rates of Snook in Florida Bay (Areas 1-5) from 1985 to 2005.

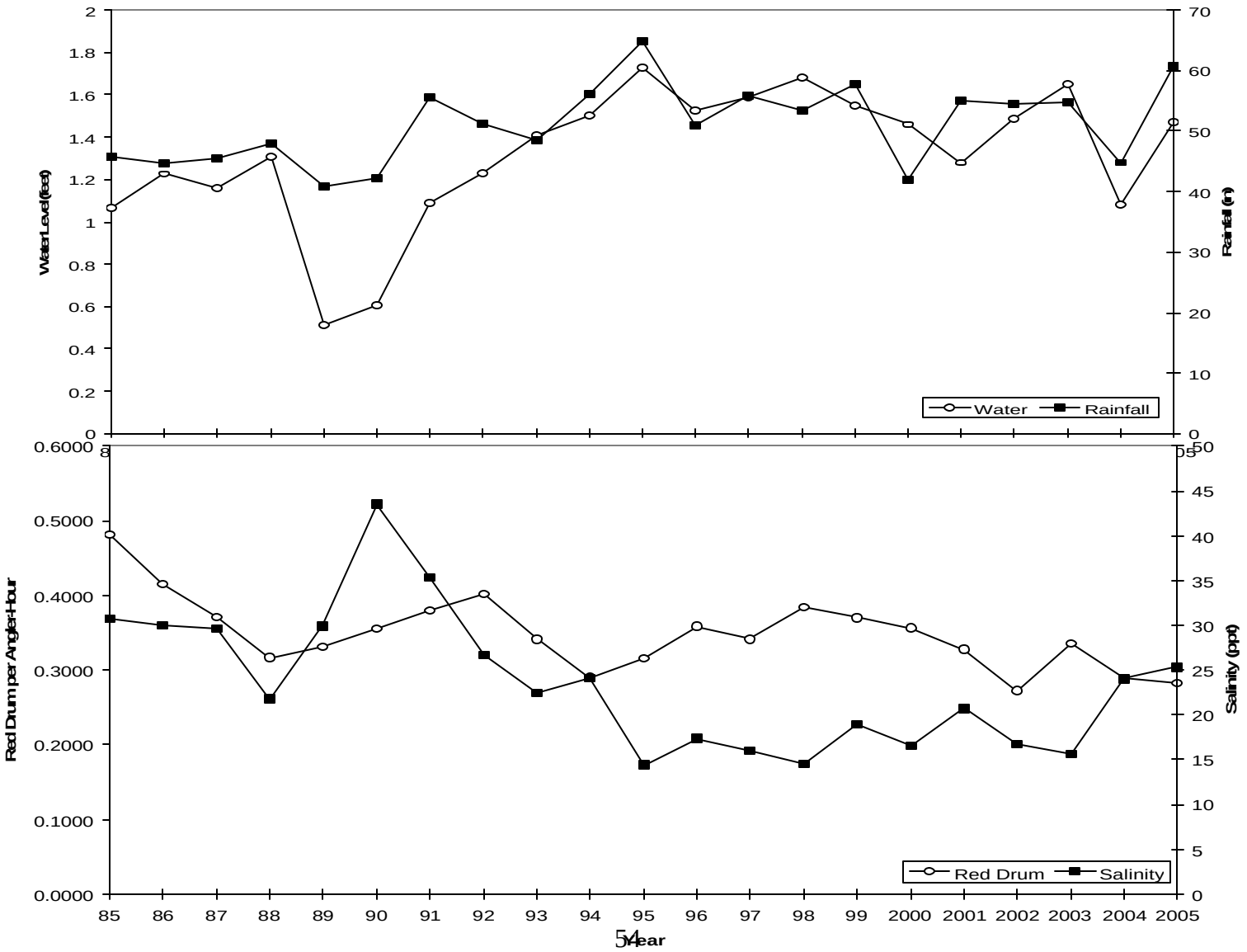


Figure 17. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and sport angler catch rates of Red Drum in Florida Bay (Areas 1-5), 1985 to 2005.

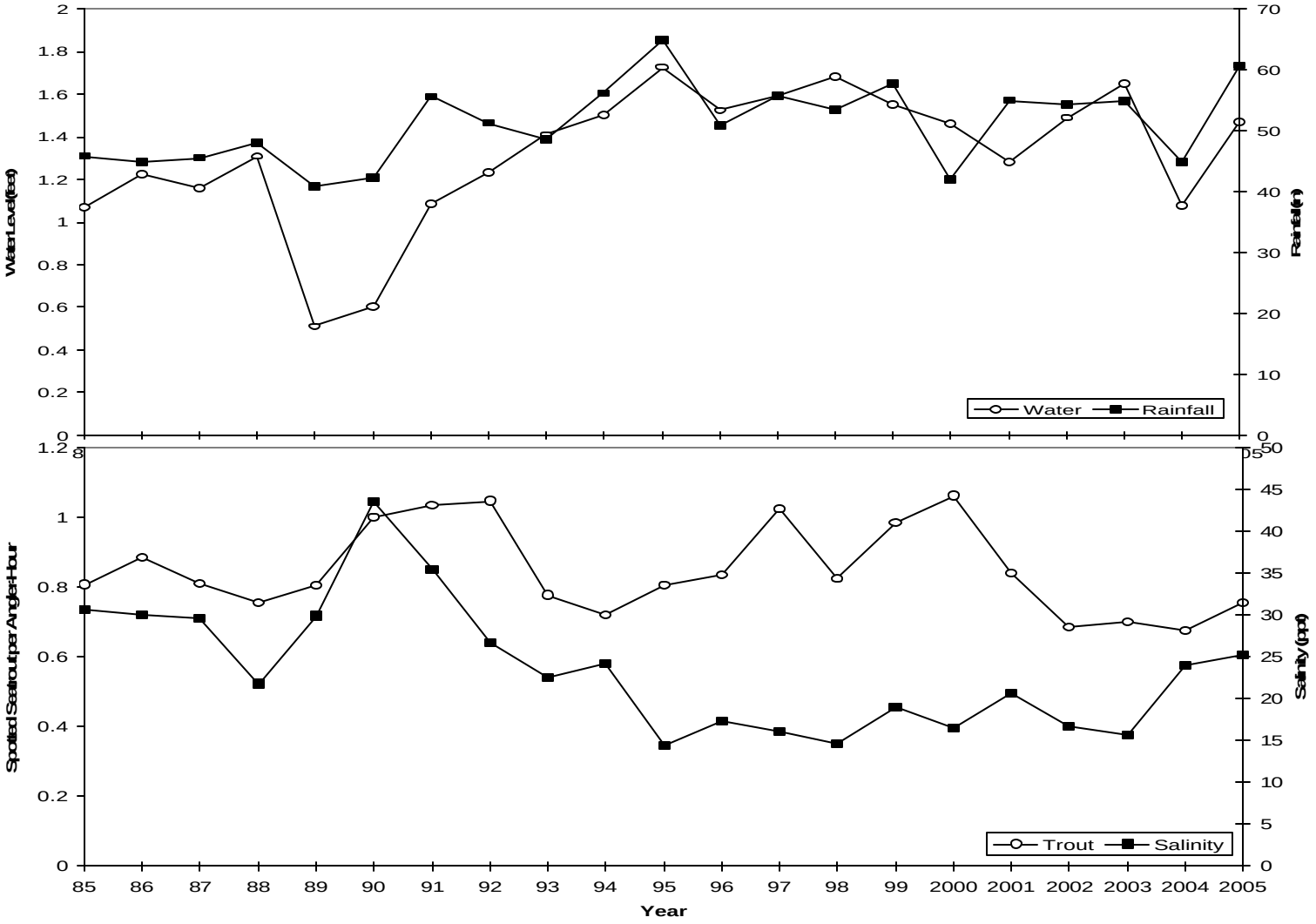


Figure 18. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and sport angler catch rates of Trout in Florida Bay (Areas 1-5) from 1985 to 2005.

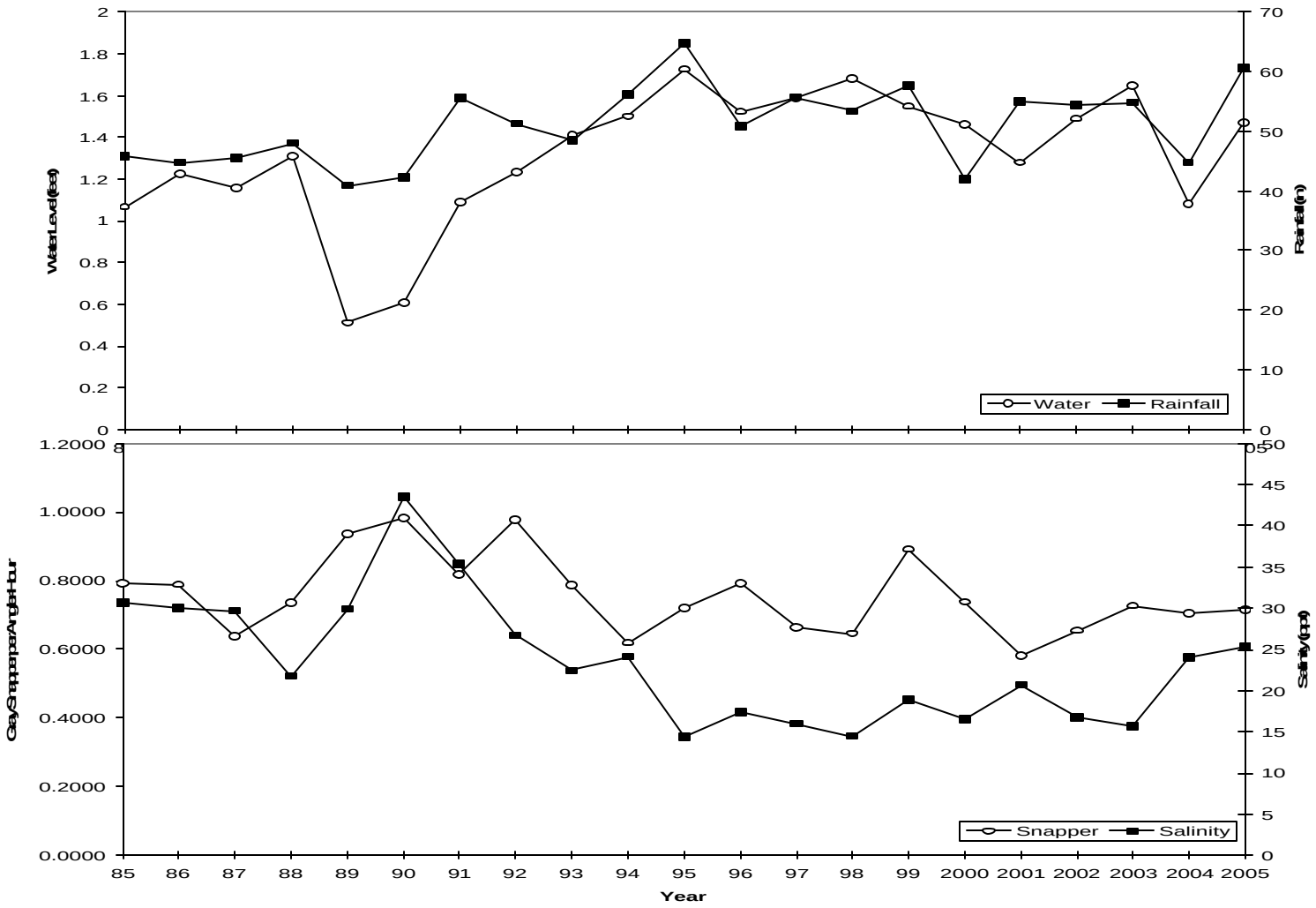


Figure 19. Average rainfall recorded at 5 stations in or near ENP, average water level at P-37 in Taylor Slough, average salinity at 2 stations in northern Florida Bay, and sport angler catch rates of Gray Snapper in Florida Bay (Areas 1-5), 1985 to 2005.

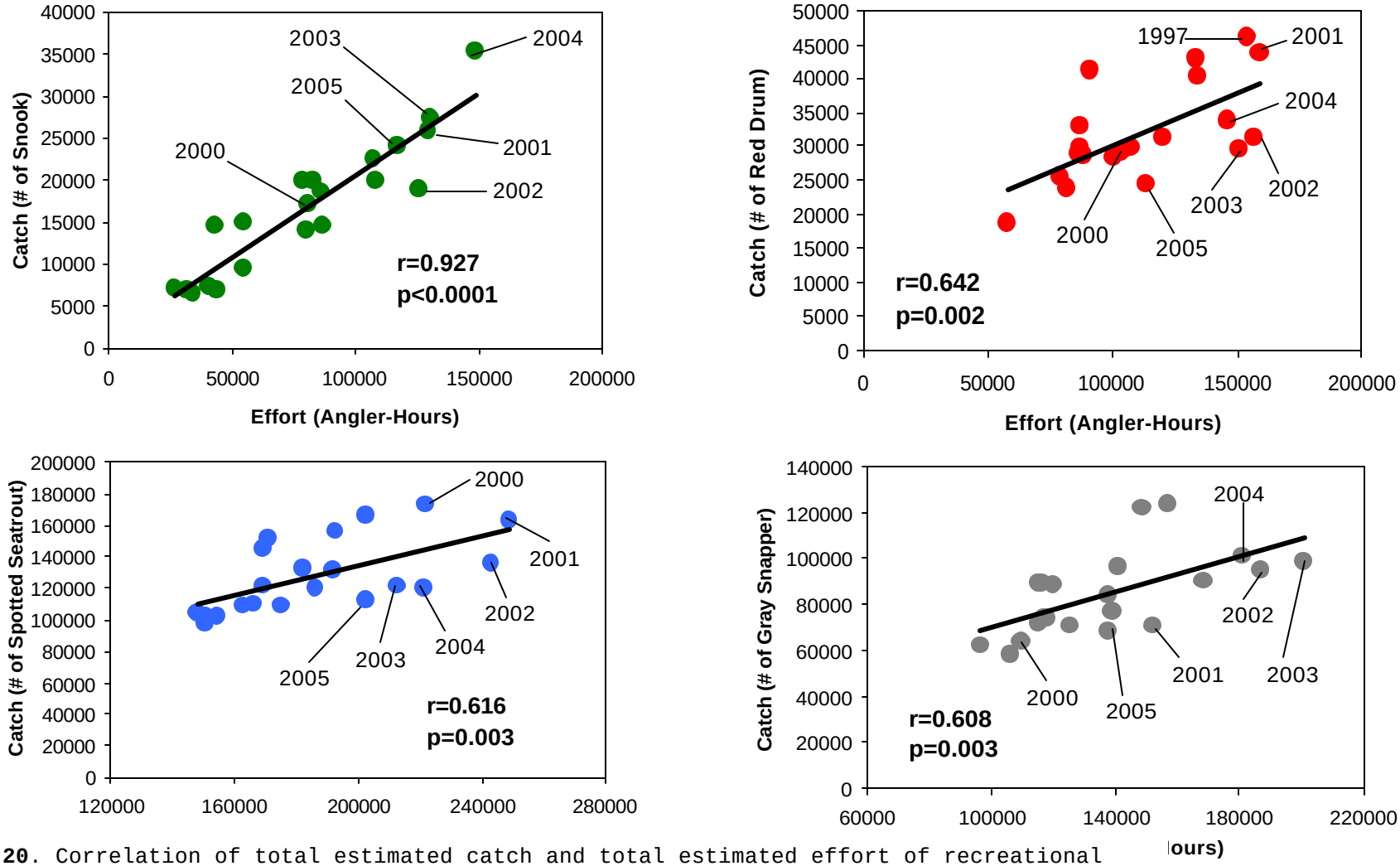


Figure 20. Correlation of total estimated catch and total estimated effort of recreational (sport) anglers fishing for snook, red drum, spotted seatrout, and gray snapper in Florida Bay (Areas 1-5), 1985-2005.